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ABSTRACT

The project PARK-IT! represents a unique partnership between a public elementary school and a city park in which students and teachers utilize a small naturalized area of the park as a Land Laboratory, and in return become its stewards. The project also includes this curriculum activity guide which can assist teachers in using the Land Lab with students in grades K-1. The guide begins with an explanation of the importance of a land laboratory, guidelines for taking students outside, and preliminary activities to prepare for going to the site. Activities are grouped by such subject areas as soil, water, plants and animals. Activities address such concepts as soil compaction, soil types, erosion, evaporation, transpiration, plant classification, animal sign, and animal safety zones. Students learn to identify tree seeds, plant seeds, and nurture seedlings. The activities include journal questions and extensions. The guidebook also includes a summary chart of activities which contains an activity overview, purpose, science skills involved, and learning outcomes keyed to fourth and sixth grade proficiency tests. (PVD)

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DEPARTMENT OF NATURAL RESOURCES
CITY OF TOLEDO

OEEF and ENVIRONMENTAL EDUCATION FUND

PARK-IT!

Elementary School Land Laboratories in Toledo City Parks

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Curriculum Activity Guide
Grades K - 1

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by

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Illustrated by
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This Curriculum Activity Guide is dedicated to all educators who strive to keep science in the field and nature in science.

Special thanks to all the elementary teachers of Toledo Public Schools who edited the draft of this resource and to the teachers and administrators who participated in the five "pilot" PARK-IT schools.

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Table of Contents

	Page
Introduction	1
Summary Chart of Park-It! Activities	13
Activities	
Soil	
Soil Content	15
Soil Compaction	19
Splatter Testing With Soil	22
Water	
Evaporation	26
Transpiration	30
Plants	
Plant Parts	35
Propagation	40
Animals	
Animal Sign Census	46
Flight Distance	50
Appendix	
Fourth and Sixth Grade Science Learning Outcomes	53

INTRODUCTION

Welcome to PARK-IT!: Elementary School Land Laboratories in Toledo City Parks! This project is jointly administered by the City of Toledo, Division of Forestry and Open Space Planning and the Toledo Public Schools and is funded by the City of Toledo and grants from the Ohio Environmental Education Fund and the Toledo Urban Forestry Commission. PARK-IT! represents a unique partnership between a public elementary school and a City Park in which students and teachers utilize a small (1/2- to 1-acre) naturalized area of the park as a Land Laboratory and, in return, become its stewards. The project also includes this Curriculum Activity Guide which will assist teachers in using the Land Lab with their students.

Why A Land Laboratory?

Using a natural area in a park or a schoolyard as a Land Laboratory is one of the easiest and most exciting ways to implement Ohio's Model Competency-Based Science Program. The Program, which defines basic scientific literacy as "the capacity of a person to be able to ask questions, collect information and make evidence-based decisions about scientific and technical issues in their [sic] own life", aims to promote scientific literacy through hands-on, inquiry-based learning which involves students working in cooperative groups (Cantrell and Barron, 1994). A PARK-IT! Land Lab accomplishes this on two levels: (1) through the guided inquiries outlined in this Activity Guide and (2) through the inquiry involved in managing the Land Lab as a natural area.

There is little doubt that one of the most important scientific issues that students will confront in their lives will be the health of the environment. The environment provides the basic needs of all living things and is a worthy focus of this Activity Guide as well as science education in general. By using inquiry to discover how soil, water, plants and animals interact and depend on one another, students will be better prepared to make decisions regarding our natural resources in the future.

Although life science and earth science are the core subject areas examined in this Activity Guide, skills from other subject areas, including language arts, mathematics, social studies and the arts, are incorporated whenever possible. As you become more comfortable teaching your class in an outdoor setting, consider adapting some of your indoor lessons in all subject areas for use outside!

Taking Your Students Outside

Leaving the controlled environment of the classroom for the great unknown of the outdoors is uncomfortable for some teachers. It is hard to imagine that a scenario which appears to invite chaos can engage the students in a way that is difficult to replicate in a classroom! By following a few simple guidelines, you can ensure that your trip to the Land Lab results in a positive learning experience for you and your students (Johnson, 1985):

1. **Establish your rules before going outside.** Be certain that your students understand what is expected of them. They need to know what they will be doing and the time frame in which they will be allowed to do it. However, do not expect the level of order that you can maintain in the classroom. It is important to permit some "controlled chaos" so that your students can explore and improve their capacity to work independently with limited distraction.

2. **Be certain that your students are dressed properly for their time in the field.** Successful field experiences can take place in all kinds of weather if everyone concerned is warm and dry. When working in tall grass or forested areas, it is a good idea to wear long pants, socks and sturdy shoes regardless of the season. Long sleeves may also be necessary if any of the children are sensitive to contact with grasses or need additional protection from the sun. Have your students wear hats, sunscreen and insect repellent if you plan to be outside for an extended period or in Spring or Autumn when sun and insects are troublesome. Winter experiences require layers of clothing, a warm coat, a hat, gloves or mittens, and boots. If possible, inform your students of a field experience at least one day in advance so that they can come to school dressed appropriately.

3. **Be sure that your students have all of the necessary equipment.** Equipment will vary depending on the purpose of your field trip, but a clipboard with paper and pencil for writing, drawing or collecting data and a magnifying lens for exploring are standard. (See the Making Your Equipment section of the Introduction for instructions on how to make an inexpensive clipboard.) If enough students have knapsacks that they can wear, encourage them to carry their equipment on their backs to keep their hands free.

4. **Consider the physical comfort of your students and try to avoid unnecessary distractions,** especially when lecturing or leading a discussion. If you will be talking for longer than a few minutes, find a dry, comfortable place for the children to sit. The fence surrounding your Land Lab has been designed to support their weight and can be used for this purpose. Use shade on a hot day, and avoid having your students sit where the sun will be in their eyes. Keep your eyes open for potential hazards, such as ant colonies and poison ivy patches. If something more exciting than your discussion is happening in the park, you may want to save your discussion for the classroom or another time!

5. **Set clear boundaries before you turn your students loose to work or explore.** Describe verbally and point out visually the landmarks which outline the portion of the park which the children will be allowed to use. Walk the boundaries as a class if your students would find this helpful.

6. **Divide your students into working groups, and assign roles or tasks within each group to facilitate cooperative learning.** Roles will depend on the type of activity that you have assigned but may include such titles as Coach or Leader, Recorder, Equipment Steward and Measurement Taker. It is important that the students have an opportunity to try a variety of roles and that they are not excluded from being actively involved in the hands-on activity by what they have been assigned to do. With a little practice, older students will be able to organize their own group work in this way.

7. **Enlist the assistance of an older class or adult volunteers** if an activity seems difficult to supervise. The extra pairs of eyes and hands can provide your students with the guidance necessary to ensure their success. Older students will also benefit from the opportunity to assume a leadership role.

8. **Seize the teachable moment.** Be flexible with your lesson, and allow your students' discoveries to become a part of it, even if they do not directly relate to the topic at hand. A praying mantis dropping in on your plant lesson could be the most memorable contribution to your students' science education that day. Use these unexpected events to their advantage.

9. **Do not be afraid to say "I don't know"** when a student presents you with a mystery object or asks you a question. The process of using your field guide library to find an answer together will be a valuable lesson for you and your students. Older students who have been oriented to the use of field guides will also benefit from the magic words, "Look it up!"

Making Your Equipment

Many teachers may be discouraged by the lack of equipment available to them for teaching science. Consequently, an apparent need for more specialized equipment can seem an insurmountable obstacle to taking your class outside. Do not let a lack of equipment discourage you. Scientific equipment does not have to be state-of-the-art. With a little creativity, you can improvise functional equipment which is both practical and inexpensive.

In most of the activities outlined in this Activity Guide, your students will be asked to make and use their own tools. Building a working model of a weather instrument or a composter has the important benefit of enabling your students to understand how the tool functions. The process exercises problem-solving skills which may eventually make it possible for your students to design their own tools. In addition, most of the projects in the Activity Guide reuse materials which would otherwise be thrown away or recycled, making them economical and environmentally sound.

- As previously mentioned, clipboards and pencils are standard issue when your class will be writing, drawing or collecting data outdoors. Because the office supply variety of clipboard can be pretty expensive, you may want to consider beginning your students' tool making careers by having them build their own.

PRE-ACTIVITY #1:
Making A Clipboard

MATERIALS
For The Class:
- Pencil
- Ruler
- Utility knife
- Scissors
- Permanent marker

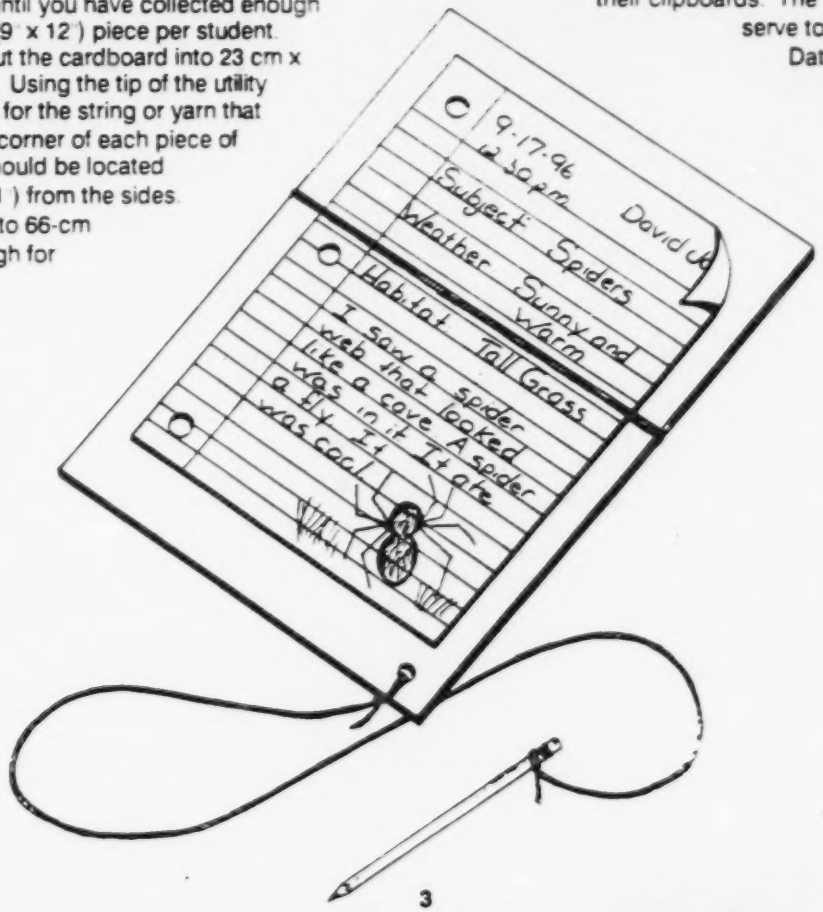
For Each Student:
- 23 cm x 30 cm (9" x 12") piece of cardboard
- #64 (3-1/2" x 1/4") rubber band
- 66 cm (26") piece of string or yarn
- Pencil
- Glue

Prepwork
Have your students bring in heavy corrugated cardboard from home until you have collected enough for one 23 cm x 30 cm (9" x 12") piece per student. Using the utility knife, cut the cardboard into 23 cm x 30 cm (9" x 12") pieces. Using the tip of the utility knife, poke a small hole for the string or yarn that you will be using in the corner of each piece of cardboard. The hole should be located approximately 2.5 cm (1") from the sides. Cut the string or yarn into 66-cm (26-inch) lengths, enough for one per student. Gather all other necessary materials.

PROCEDURE
1. Distribute a 23 cm x 30 cm (9" x 12") piece of cardboard, a rubber band, a 66-cm (26-inch) length of string or yarn, a pencil and glue to each student. Have each student orient his or her cardboard so that the hole which you poked is in the bottom right corner for a right-hander or the bottom left corner for a left- hander. Write each student's name across the bottom of his or her piece of cardboard with permanent marker.

2. Have the students tie one end of their strings through the holes in their pieces of cardboard. Have them tie the other end of their strings to their pencils just above the erasers. Wrapping the string around the pencil twice before tying it and anchoring it with glue will prevent the string from sliding off the pencil when the clipboard is in use.

3. Have the students wrap the rubber bands around their clipboards. The rubber band will serve to hold a paper or Data Sheet in place.


9-17-96
12:30 pm
David
Subject: Spiders
Weather Sunny and warm
Habitat Tall Grass
I saw a spider web that looked like a cave. A spider was in it. It ate a fly. It was cool.

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4. Have the students tuck their pencils under their rubber bands for storage. Collect the clipboards for storage in a centralized location, or have your students store them in their desks.

Another standard piece of equipment which you should prepare for your use before using the Land Lab is a collection of marking stakes. Marking stakes can be used for a variety of purposes, including marking planting sites, setting working boundaries for your students and making other classes aware of a study area. You can make your own by cutting furring strips or other similar scrap lumber into 30-cm (12-inch) lengths and painting the top of each stake with fluorescent paint to increase its visibility. Using an angled cut to create a point on the bottom of the stake makes it much easier to drive into the ground. You should prepare one to two dozen stakes to start.

Finally, to facilitate the making of tools and maintenance of your Land Lab, consider purchasing or borrowing a hammer and encouraging your students to bring in "throwaways" from home for as long as available storage space allows. The hammer can be used for driving marking stakes and for simple maintenance and construction projects. The on-going collection of throwaways could include gallon milk jugs for carrying water; 5-gallon laundry soap, spackle and pickle buckets for carrying mulch and equipment; and heavy corrugated cardboard, scrap lumber, 2-liter pop bottles, quart milk cartons and half-gallon juice cans for tool making. End rolls of newsprint can be obtained free-of-charge from the Education Coordinator at *The Toledo Blade*. By pooling your resources with those of other classes, you will easily realize the goal of having adequate equipment for teaching science in your Land Lab.

Respecting Habitat And Inhabitants

In creating a PARK-IT! Land Lab in the park adjoining your school, the City of Toledo and the Toledo Public Schools have allowed a new home for wildlife to grow. Our actions have extended an invitation to animals which utilize the type of habitat provided by the Land Lab to take up residence. With the invitation comes a responsibility to respect the habitat and the animals that will come to live in it. It is important to remind your students of this and to set an example when using the Land Lab.

1. **Use dropped leaves, fruit and flowers for your studies whenever possible**. When you are finished, encourage your students to return these things to the places where they were found, recognizing the importance of dead plants and animals to the soil and the circle of life in general. If you must use part of a living plant, take only what you need (one leaf, one twig) and remove the part with pruning shears or a similar tool instead of tearing it off. The clean cut minimizes damage to the plant's tissues. Return whatever you use to the Land Lab when you are finished with it.

2. **Teach your students to observe all animals from a safe distance**, a distance at which they are not perceived as a threat by the animals. This will enable them to observe the animals' normal behavior and not just behavior based on fear. For instructions on determining a safe distance from which to observe animals, see the Flight Distance activity for grades K-1.

3. **Never disturb a nest.** Frequent visitation of an animal home constitutes harassment and can interfere with the inhabitants' efforts to feed or rear their young.

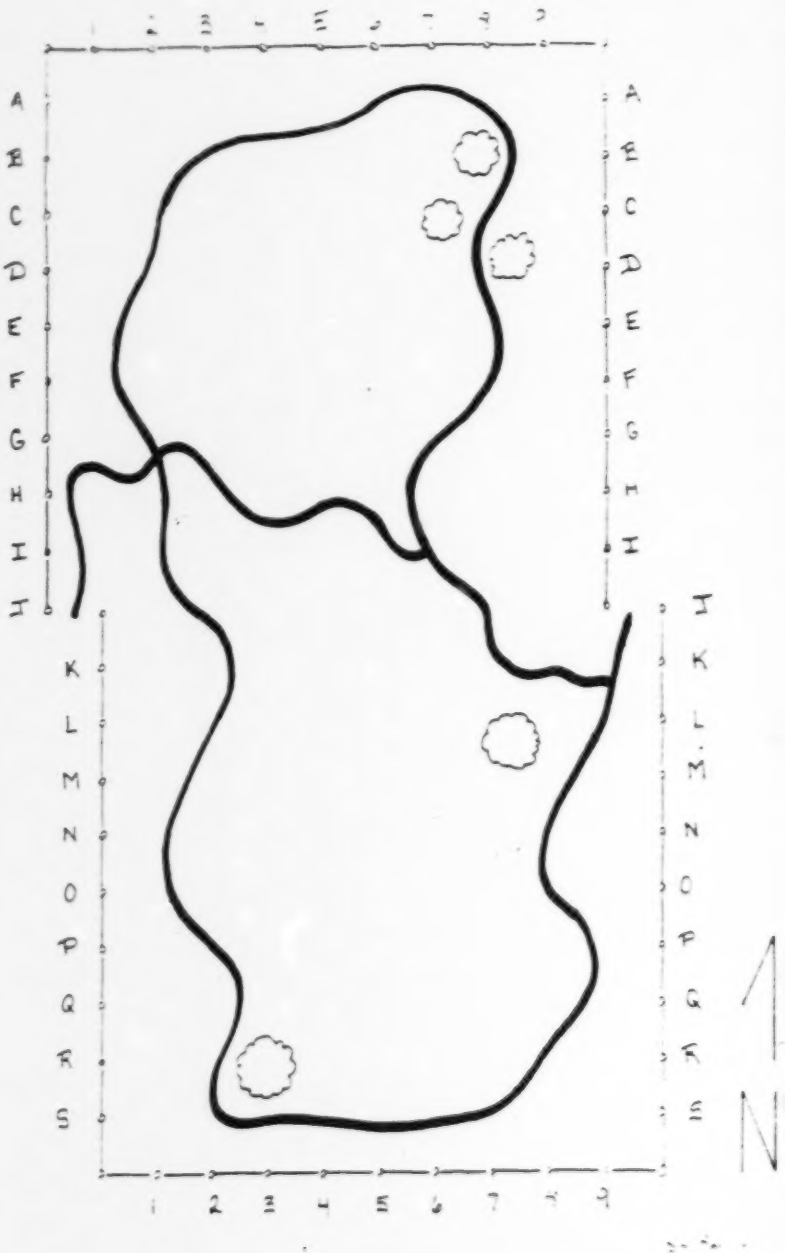
4. **Do your homework before allowing your students to handle any wildlife,** including insects, earthworms and pill bugs. Consult a resource which outlines humane handling and care of the species of interest such as *Animals Alive!: An Ecological Guide to Animal Activities* by Dennis Holley. Be sure to release the animals at the exact location where they were found and at a time when they will not be hindered by inclement weather or lack of food. Your example will form the basis of your students' future interactions with habitat and its wild inhabitants.

Getting To Know Your Land Lab

Your PARK-IT! Land Lab consists of one-half to one acre of City Park land enclosed by a split rail fence. The perimeter established by the fence is rectangular or square in shape, and the fence posts are set square to one another so that the posts can be labeled with x coordinates (letters) and y coordinates (numbers) on an x-y axis. These coordinates can be used by you and your students to locate planting sites and study areas and to compile a base map of the Land Lab.

Compiling a base map is an excellent way to become familiar with the contents of your Land Lab. By placing a large map of the Land Lab on a bulletin board in your classroom, you will be able to orient your students to areas in which you will be working. The map could be used to keep an accurate record of changes in the Land Lab as they occur. It would also be advantageous to create a master of the base map to photocopy for your students to include in their journals or to prepare an overhead transparency.

To begin mapping, you and your students will need to take some measurements. Measuring can be done with a tape measure or by providing each student with his or her own measuring tool: the length of a pace.



Example of a Land Lab Map
5

PRE-ACTIVITY #2:
Determining The Length Of A Pace

MATERIALS
For The Class:
- Tape measure or other measuring device
- Marking stakes (2)

For Each Pair Of Students:
- Clipboard with pencil
- Scrap paper for calculations

PROCEDURE
1. Measure 30 meters (100 feet) with the tape measure or other measuring device, and mark off the distance with marking stakes.

2. Have your students line up behind one of the stakes facing the other. Explain to them that they will be walking the distance marked one at a time, beginning with their left feet and counting the number of times that their right feet hit the ground. A pace is equivalent to two steps. At your instruction, have each student count the number of paces required to walk the distance. Encourage your students to walk as normally as possible and to try not to make their steps bigger or smaller.

3. Have each student repeat the procedure three times and then calculate the average number of paces required to walk the distance. This is accomplished by adding the results of the three trials together and dividing by three.

4. Divide or have your students divide 30 m (100') by the average number of paces required to cover the distance to yield the length of one of their paces.

5. Have the students practice measuring unknown distances. Have them walk the distances while counting their paces and then multiply the number of paces required to cover each distance by the length of one pace. The students can also mark off a desired distance by dividing the distance by the length of one pace and walking the desired number of paces.

Once you and your students have determined the length of each person's pace, you can use pacing to take the measurements necessary to compile a base map of the Land Lab.

PRE-ACTIVITY #3:
Compiling A Base Map

MATERIALS
For The Class:
- Measuring tape or other measuring device (if pacing will not be used)
- Clipboard with pencil
- Scrap paper for recording measurements
- Large sheet of newsprint
- Meter stick or yardstick
- Permanent marker

For Each Student Or Group Of Students:
- Clipboard with pencil
- Blank sheet of paper or grid sheet
- Ruler
- Crayons or markers for coloring, if desired

PROCEDURE
1. Have your students measure the perimeter of the Land Lab and the distance between the fence posts or points of intersection of the x and y coordinates. Measuring can be done with a tape measure or by pacing. Record the measurements on your sheet of scrap paper. Return to the classroom.

2. Establish a scale for the map. A scale can be determined by selecting a desired size for the finished map and dividing the length of one of its sides by the actual length of that side of the Land Lab. For a large sheet of newsprint 2 meters in length, 2 meters may be divided by the length of the side of the Land Lab (64 meters) to yield a scale of 0.03125 meters or 3 centimeters to 1 meter of Land Lab.

$$\frac{\text{2 meters (size of the map)}}{\text{64 meters (size of the Land Lab)}} =$$

$$\frac{\text{0.03125 meter}}{\text{1 meter}} =$$

$$\frac{\text{3 centimeters}}{\text{1 meter}} \quad \text{or} \quad \frac{\text{1 inch}}{\text{3 feet}}$$

For a sheet of typing paper 28 centimeters in length, 0.28 meter may be divided by the length of the side of the Land Lab (64 meters) to yield a scale of 0.004 meter or 0.4 centimeter to 1 meter of Land Lab.

Multiplying through by 5 yields the scale in whole numbers: 2 centimeters to 5 meters of Land Lab.

$$\frac{\text{0.28 meter (size of the map)}}{\text{64 meters (size of the Land Lab)}} =$$

$$\frac{\text{0.004 meter}}{\text{1 meter}} =$$

$$\frac{\text{0.4 centimeter}}{\text{1 meter}} \times \frac{5}{5} =$$

$$\frac{\text{2 centimeters}}{\text{5 meters}} \quad \text{or} \quad \frac{\text{1 inch}}{\text{15 feet}}$$

3. Use the scale to draw the perimeter of the Land Lab and the grid delineated by the fence posts on the large sheet of newsprint. The grid may also be drawn individually on a blank sheet of paper by each student or small groups of students. You may wish to prepare a master of the grid and photocopy it for younger students. Be sure to have the students label the x and y coordinates and include the scale under the map.

4. Return to the Land Lab with grids and clipboards with pencils to add details to the map. The procedure will vary according to the abilities of the students. Younger students can draw landmarks such as trees, stumps and trails as they appear within the rectangle or square. Older students can identify the x and y coordinates for each landmark and plot them on the grid. For an even more accurate map, have the students use the fence posts, marking stakes and string to construct a grid over each section of the Land Lab and transfer the contents of each individual square to the corresponding square on the map. Encourage the students to label the map in as much detail as possible.

5. Upon returning to the classroom, allow your students to color their maps, if desired. Instruct them to include the maps in their personal science journals, if applicable.

Regardless of the method used, this mapping exercise will sharpen your students' math skills and introduce them to the physical layout of the Land Lab. To draw their attention to details that might not appear on the map, design and conduct a scavenger hunt with your students.

PRE-ACTIVITY #4:
Conducting A Scavenger Hunt

MATERIALS

For Each Student:

- Clipboard with pencil
- Copy of brainstormed scavenger hunt checklist
- Crayons for coloring, if desired

PROCEDURE

1. Together with your students, brainstorm a list of scavenger hunt items that they would expect to find in the Land Lab. Write the students' ideas on the chalkboard. You may want to provide rough sketches of the items for younger students.

2. Have each student prepare a checklist of the items listed on the chalkboard using phrases and/or pictures. Checklists which include pictures may be colored, if desired. Distribute clipboards with pencils to your students, and have them attach their checklists to their clipboards. Go to the Land Lab.

3. Establish boundaries for the scavenger hunt, and outline any limits which you wish to place on collecting. Then turn your students loose to find as many of the items as they can. They will truly enjoy this initial unstructured time to explore.

4. Conclude the scavenger hunt by having the students share their findings. Did they find the items that they expected to find? Did they find the unexpected?

Caring For Your Land Lab

Your Land Lab encompasses a significant portion of a City Park. Like any City Park facility, it is for use by the citizens of Toledo and is therefore subject to wear and tear.

Each PARK-IT! Land Lab has signs posted near its entrances. These signs describe the PARK-IT! project, what a Land Lab is and how it is used and may be enjoyed. The signs also list guidelines for users to bear in mind. A sample of such a sign is shown below for your reference.

If you and/or your students notice fence rails are down, please return them to their original position. If fence rails or fence posts are broken or missing, please call the Naturalist staff at the Ottawa Park Nature Education Center at (419) 936-2876. If vandalism is witnessed, please call 911 immediately and then inform the Ottawa Park Nature Education Center of the incident.

Trees which have been subject to vandalism or storm damage should also be brought to the attention of the Ottawa Park Nature Education Center. A dead tree may not be replaced, but an injured tree may be saved through trimming by the Naturalist staff.

The greatest threat to the trees of your Land Lab is insufficient and improper watering. Trees, especially young, newly planted ones, require a lot of water: as much as 10 gallons per week in the Spring and Summer. Water should be applied slowly. You can ensure sufficient watering at a desirable rate of flow by making watering buckets and instructing your students in their use.

Burroughs School and Burroughs Park
Introduce PARK - IT!
Elementary School Land Laboratories
in Toledo City Parks.
WELCOME!

This fence was built to enclose one acre of this City Park for use as a Land Laboratory. A Land Lab, or outdoor classroom, provides space and opportunities for children and all Toledoans to learn about environmental processes in a hands-on way. Children from nearby schools, scout groups, and community organizations use this Land Lab to see how the natural world works. Feel free to explore the Land Lab. For everyone's enjoyment, please:

1. Stay on the woodchipped trail(s).
2. Leave all plants and animals undisturbed.
3. Put trash in trash cans.
4. Observe all Toledo City Park Rules.

Land Lab Sign

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DEPARTMENT OF NATURAL RESOURCES CITY OF TOLEDO

PRE-ACTIVITY #5:
Making And Using Watering Buckets

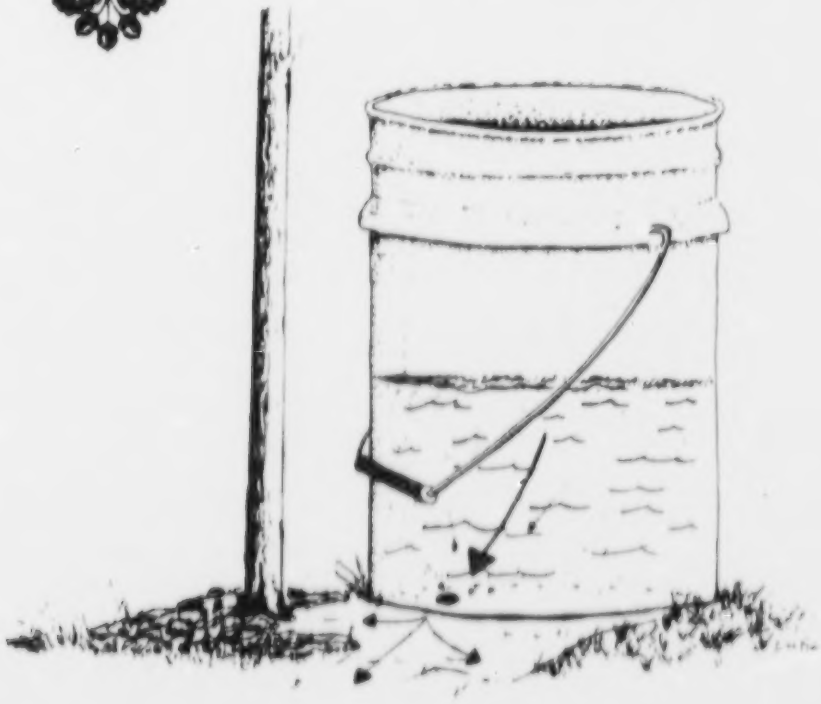
MATERIALS
For The Class:
- 5-gallon plastic bucket (1 per watering bucket)
- Electric drill
- 3/8" drill bit
- gallon milk jugs (5 per watering bucket)

PROCEDURE
1. Drill a 1-cm (3/8") hole in the base of each 5-gallon bucket. Your watering bucket is now complete! Fill the gallon milk jugs with water and cap them. Have your students carry the watering bucket or buckets and the milk jugs of water to the Land Lab.

2. Have your students place each watering bucket on the mulch mound over the roots of a subject tree. Have them pour 5 gallons water from the milk jugs into each watering bucket. The water will slowly trickle from the 1-cm (3/8") hole, through the mulch mound and into the ground.

Woodchip mulch is an ideal material to apply on Land Lab trails. The woodchips reduce erosion and prevent plants from growing on the trail. Woodchips are our recommended mulch to place around newly planted trees and shrubs. Mulch prevents grasses and weeds from directly competing with trees for water. It also helps the soil retain water by reducing evaporation. When mulching beneath a tree, make sure the depth of the mulch bed does not exceed 10 centimeters (4 inches).

Woodchips are also an inexpensive way to prepare a planting bed for flowers or other plants which you and your class integrate into your Land Lab. After establishing boundaries of a potential planting bed site, spread a blanket of woodchips 10-15 centimeters (4-6 inches) deep over the area. The woodchips can be applied with 5-gallon buckets. Within a few weeks, the mulch will have killed the vegetation beneath it. Remove the woodchips from the area. Your planting bed is now ready for planting and regular watering. The woodchips which you have removed can be reused for other planting projects. Please call the Ottawa Park Nature Education Center if your Land Lab is in need of woodchips.



Watering Bucket

Using Your Land Lab

In addition to caring for your Land Lab, you and your students will share the responsibility of compiling a class journal. The class journal is one of the evaluation requirements of the PARK-IT! project. Its contents are left to your discretion but should document your class' use of the Land Lab through student writings, drawings, pictures and Data Sheets. In addition to allowing an outside observer to become familiar with your work in the Land Lab, the class journal will assist you with long-term record keeping. It will allow your current class to compare the results of their studies with those of any previous classes. This opportunity to compare could prove invaluable to your science teaching as the Land Lab grows and changes.

Although they are by no means required, you are also urged to assist your students in preparing personal journals. Like the class journal, the personal journal is probably best organized in a three-ring binder. This format enables your students to divide their journals into sections of handouts, writings, drawings or Data Sheets and to add information gathered in the Land Lab without having to take the entire journal outside. Encourage your students to decorate their journals, and set aside time during the course of each activity to use them in some way. The students can use writing to focus their thoughts, to keep track of their learning, to plan how they will solve a problem, to take notes and comment on their reading and to reflect on their experiences (Hogan, 1994). If you or your students have trouble getting started or using the journal on a regular basis, you can consult the JOURNAL QUESTIONS section near the end of each activity in this Activity Guide for a suggested journal entry which will reinforce the lesson.

As stewards of a PARK-IT! Land Lab, the role of your school's faculty, staff and students extends beyond basic maintenance and record keeping. You will all have a say in what the natural area actually becomes. By planting seeds and encouraging certain types of growth, you will be partners with the natural process of succession in creating a specific kind or kinds of habitat. Although management decisions will ultimately be made by your school's designated PARK-IT! Committee, you and your students should engage in on-going discussion about what you would like to see happen to the Land Lab. Submit your ideas to the Committee for consideration. If your suggestions meet with approval, encourage your students to follow through with them. **Before initiating any planting project or on-going study, discuss the location with the PARK-IT! Committee to avoid disturbing the projects of other classes.**

Your final responsibility as a steward of your PARK-IT! Land Lab is to utilize the Land Lab for the purpose for which it is intended: to provide quality hands-on science experiences for your students. You may have dozens of ideas on how to implement this or feel a little overwhelmed by the thought. This Curriculum Activity Guide was written with both scenarios in mind. It includes 25 activities, eight or nine per grade level grouping (K-1, 2-3 and 4-6). These activities focus on soil, water, plants or animals as they can be observed in the Land Lab and are written in a complete, easy-to-follow format. An explanation of the format follows.

The **TITLE** includes the subject of the lesson and a tongue-in-cheek subtitle for your entertainment.

GRADE LEVEL/TOPIC indicates the grade level grouping for which the activity was developed and the broad category into which it fits: Soil, Water, Plants or Animals.

TIME REQUIRED/RECOMMENDED SEASON offers an estimate of the time which it will take to complete the activity and the season of the year during which the activity is likely to work best. It indicates if the activity must be done in more than one session or is ongoing.

SCIENCE SKILLS lists those skills involved in the learning and practice of science which are used in the activity.

KEY WORDS lists vocabulary which may be used to prepare your students for the activity. These terms are highlighted in the **BACKGROUND INFORMATION** using bold type.

The **OVERVIEW** summarizes the activity and indicates the types of learning experiences which are included. It suggests how the time required may be divided among these experiences to aid you in breaking the lesson into shorter segments which accommodate your time allocation for science.

The **PURPOSE** states what the students will do or be able to do as a result of completing the activity.

MATERIALS provides an itemized list of the materials recommended to carry out the activity and indicates whether they are needed for the class, for a group of students or for each individual student. The Prepwork section outlines those preparations which you will need to make to get the materials ready for use in the activity. Improvising is encouraged!

The **BACKGROUND INFORMATION** provides you with some expertise in the subject of the activity so that you can successfully brief your students prior to their participation in the activity.

The **BEFORE YOU GO** section details the steps which you will take to prepare your students in the classroom before going outside.

The **PROCEDURE** is the body of the activity which takes place in or focuses on the Land Lab. It is presented in a step-by-step format.

The **CONCLUSION** outlines a follow-up exercise or exercises for the classroom which provide closure to the activity.

JOURNAL QUESTIONS suggests a way to use the students' personal journals to reinforce what they have learned from the activity.

EXTENSIONS offers additional activities which you can use to build on what your students have learned if their interest indicates that they want to know more.

REFERENCES/ADDITIONAL READING lists literature cited and used to compile the activity and other resources which you may find helpful in teaching your students about the subject matter. Books which are available at the Toledo/Lucas County Public Library are indicated by the initials TLCPL in parentheses. Most other titles may be obtained through inter-library loan.

CHILDREN'S SCIENCE/TRADE BOOKS lists children's literature which may be used in conjunction with the activity. Books which are available at the Toledo/Lucas County Public Library are indicated by the initials TLCPL in parentheses.

Some of the activities include Instruction Sheets for making tools, Data Sheets for collecting and recording data and other handouts for student use. Templates are included for most craft projects, and illustrations are found throughout the activities which clarify the text. For an overview of all of the activities in this Activity Guide, including titles, summaries, purposes, science skills and learning outcomes addressed, please consult the chart at the end of the Introduction.

Most of the activities in this Guide are guided inquiries. The explorations and experiments have been designed for you and your students. However, one of the desired outcomes of science learning is for your students to acquire the ability to design and plan their own explorations and experiments. Whenever possible, have your students use the background information which you have discussed with them to make predictions, or hypotheses, which can be tested during the course of the activity. By highlighting the scientific process in each guided inquiry, you can provide your students with the confidence that they will need to strike out on their own. When they do, the possibilities for using your Land Lab will be endless.

Happy sciencing!

References/Additional Reading

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PARK-IT!
Activity Summary

Title	Overview **This Activity Consists Of ...**	Purpose **The Students Will ...**	Science Skills	Learning Outcomes **See Appendix**
K-1				
Soil Content *Sorting It Out*	A demonstration of soil particles, field test of soil and a game.	Be able to distinguish between different sizes of soil particles and predict that the largest ones are the heaviest.	Observing, Predicting, Collecting	1,2,6
Soil Compaction *Puddles Under The Swing Set*	A demonstration of compaction , a field test of soil and a demonstration of how aeration improves soil quality.	Observe that well aerated soil absorbs more water than those soils which are compacted.	Observing, Comparing, Predicting	6,8,11,12,14,15,17
Splatter Testing *Keeping It Together*	A demonstration of erosion and its effects.	Observe the action of water on soil and the ability of vegetation to reduce this effect.	Observing	2,5,6,11,14,15
Transpiration *Plants Don't Sweat They Transpire*	A demonstration of water storage in plants, observation of a solar still and a worksheet.	Demonstrate that living plants store water and trace the path of water through a plant.	Observing, Questioning, Model Building	2,6,7,16
Evaporation *Which Way Did It Go?*	A search to find a place in the Land Lab where water will evaporate the most quickly.	Observe that water has three forms and name some factors which influence evaporation.	Observing, Hypothesis Testing, Questioning	2,5,6,7,8,11
Plant Parts *Look Ma, No Hands*	Matching game with plants in the classroom and a scavenger hunt in the Land Lab.	Match illustrations of plant parts with plants in the Land Lab, and color those illustrations.	Observing, Record Keeping	2,4,6,7,8,16,17
Propagation *From Seed To Tree*	An introduction to types of tree seeds, selection and planting of and caring for seeds.	Recognize that fruits contain seeds and plant and properly care for tree seeds.	Observing, Collecting, Record Keeping	1,6,14,16,17
Animal Sign Census *Who Goes There?*	A comparison of the Land Lab and other areas of the park in terms of animal sign.	Identify animal sign and recognize that more sign will be found in the Land Lab.	Observing, Questioning, Record Keeping, Censusing	2,4,6,7,14,16,17
Flight Distance *I Need My Space*	Demonstrations of proximity, field testing of ideas and a game.	Show that animals need space.	Observing, Questioning, Measuring	2,3,5,6,8,12,16,17
2-3				
Soil Permeability *Down The Soil Drain*	Constructing a measuring device, field testing of the device and producing group reports.	Construct and use a measuring device to determine soil permeability and explain how land use effects the ability of soil to absorb water.	Tool Making, Observing, Data Collecting and Recording, Measuring	2,3,5,6,8,14,15,16, 17,18
Rate Of Decomposition Of Leaf Species *Now You See It Now You Don't*	Making leaf rubbings as an aid to identification, building a mulch pile and monitoring the rate of decomposition of leaves from different species of trees.	Identify leaves from five different species of trees, compare and contrast the rates of decomposition of those leaves over the school year.	Observing, Collecting, Identifying, Record Keeping, Mapping	1,4,5,6,8,14,16
Weather Station *Whether We Like It Or Not*	Making and using simple instruments to monitor the weather.	Construct weather-monitoring devices and describe how the water cycle and temperature contribute to daily weather.	Observing, Data Collecting and Recording Record Keeping, Monitoring, Measuring, Tool Making and Use	2,3,5,6,7,8,9,10 12,13,14
Snow - How It Changes Life For Animals *Snow What If I'm Up To My Tail In Snow?*	Building a snow pile to explore temperature and density of snow.	Describe ways snow influences the behavior of animals and observe and quantify characteristics of snow.	Observing, Collecting and Recording Data	3,6,8,9,11,16 17
Growth Of Propagated Plants *How Does Your Land Lab Grow?*	An introduction to tree growth, measuring and drawing seedlings in the Land Lab.	Observe characteristics of a growing plant and produce a scale illustration of a plant based on data from the Land Lab.	Observing, Measuring, Mapping, Record Keeping	2,3,6,7,14,16

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Park-It!
Activity Summary, Continued

Title :	Overview **This Activity Consists Of ...**	Purpose **The Students Will ...**	Science Skills	Learning Outcomes **See Appendix**
2-3, Continued				
Native Versus Non-Native Plants *Alien Invaders*	Removing dandelions from a plot in the Land Lab and observing their short regeneration time.	Identify physical characteristics shared by non-native plants and use a removal technique to demonstrate how and why they are so successful.	Observing, Censusing, Sampling, Record Keeping, Mapping, Comparing and Contrasting	1,4,5,6,8,14,16,17
Food Preferences Of Neighborhood Birds *If You Were The Early Bird, Would You Eat A Worm?*	Establishing a bird feeding station and determining what and where the birds like to eat.	Determine food preferences of birds and use that information to make recommendations for permanent feeders.	Observing, Collecting and Recording Data, Experimental Design, Identifying, Monitoring	2,4,16,17
Common Insects Which Use Plants *Look Who's Been Eating My Land Lab*	Building insect models, looking for insects in the Land Lab and follow-up discussions	Give examples of insects which use plants and identify insect sign on plants.	Model Building, Observing, Identifying, Record Keeping, Comparing	1,4,8,16,17
4-6				
Soil Making Composting *It's A Dirty Job ...*	Constructing a pop bottle composter and useing it to study the soil-making process.	Identify the components of soil. Make small composters and use the resulting compost in a planting project.	Observing, Collecting, Monitoring, Record Keeping, Predicting, Hypothesis Testing	3,4,5,8,12,13,15 17
Inventory Of Worm Castings *This Too Shall Pass*	Constructing a grid to use in a field experiment and the mapping and measuring of worm castings.	Set up, map and inventory plots where they will estimate the soil-making capacity of worms in the Land Lab.	Tool Making, Observing, Sampling, Mapping, Monitoring, Collecting and Recording Data	3,5,12,14,17
Water In The Atmosphere *Up In Vapor*	Constructing and using weather instruments.	Compare and predict differences in atmospheric conditions between the Land Lab and a mowed lawn.	Observing, Measuring, Monitoring, Collecting and Recording Data, Predicting, Hypothesis Testing, Tool Making	5,7,8,10,13
Pollination *Sex And The Single Flower*	Constructing a model of a flower to attract insect pollinators.	Demonstrate features of a flower through model building and describe the process of pollination and seed formation.	Observation, Collecting and Recording Data, Model Building, Monitoring, Predicting	3,5,10,13,14
Seed Dispersal *I Get Around*	Constructing a model of a seed and a device with which pollen and seeds can be trapped.	Identify methods of seed dispersal and design an experiment to allow for the capture of seeds and pollen.	Observing, Collecting and Recording Data, Identifying, Experimental Design	1,3,5,7,10,15
Succession *One Thing Leads To Another*	Setting up a transect and collecting data about plants in the Land Lab.	Use a transect to collect data and contribute to an on-going record of changes in the plants of the Land Lab over time.	Observing, Monitoring, Experimental Design, Measuring, Collecting and Recording Data	3,4,5,10,14,15
Invertebrate Censusing *The Spineless Wonders*	Censusing of invertebrates and a mark-and-recapture study of grasshoppers.	Distinguish between orders of insects, construct and use a sweep net to census invertebrates and estimate population size of grasshoppers in the Land Lab.	Sampling, Identifying, Censusing, Collecting and Recording Data, Graphing, Comparing, Analyzing	1,2,3,5,15,17
Spider Observation *Look! It's A Spider Man!*	Baiting and observing the feeding behavior of funnel spiders, model building and letter writing.	Describe feeding behavior of funnel spiders and record their observations by using a field notebook. Also will write a letter and build a model.	Observing, Model Building, Note Taking, Record Keeping	2,3,5,6,10,14,15

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D.M. Garvin

Soil Content

Soil Content
Sorting It Out

GRADE LEVEL/TOPIC: K-1/Soil

TIME REQUIRED/RECOMMENDED SEASON: 90 to 120 minutes /Spring or Autumn

SCIENCE SKILLS: Observing, Collecting, Predicting

KEY WORDS: Soil, Sand, Silt, Clay, Particle, Layers, Gritty, Smooth, Settle, Living, Non-living

OVERVIEW

This Activity introduces the three types of rock particles found in soil (sand, silt and clay). It utilizes simple field tests, including suspending a soil sample in water and allowing it to settle, to examine these particles in the Land Lab. It consists of an indoor examination of soil particles and demonstration (30-45 minutes), field testing of soil in the Land Lab (30-45 minutes) and a follow-up game using touch to describe or identify soil particles (15-30 minutes). This Activity may be divided into shorter sessions to accommodate your time allocation for science. If this is your first trip to the Land Lab, please consult the Introduction.

PURPOSE

1. Students will be able to distinguish between three types of soil particles and describe the texture of each.

2. Students will be able to predict that bigger, heavier particles will make up the bottom layer after settling out in water.

MATERIALS

For The Class:

- Large glass jars with lids for demonstration (2)
- Aluminum pie pans containing sand, potting soil (silt), clay and fine gravel or small stones (4 one pan for each particle)
- Large labels for stations marked "SAND", "SILT", CLAY" and ROCKS"
- Empty aluminum pie pan for mixing
- Gallon milk jug of water
- Paper towels
- Optional: Blindfolds (4)

For Each Student:

- Magnifying lens
- Metal spoon

Prepwork

Collect samples of sand, potting soil (silt), clay and fine gravel or stones. Place the samples into separate aluminum pie pans. There should be enough of each to fill the pans. Prepare a large label for each of the samples by writing "SAND", "SILT", "CLAY" and "ROCKS" on pieces of heavy paper or cardboard. Organize the aluminum pie pans with their labels into four work stations for the students. Fill a gallon milk jug with water, and cap it. Gather all other necessary materials.

BACKGROUND INFORMATION

Soil is the necessary substrate for a majority of plants. As such, it is an invaluable material, one that deserves to be better understood. In this activity, your students will examine one of the basic components of soil: rock particles.

Soil is composed of five basic components: rock particles, air, water, living organisms and organic material. Organic material is produced by **living** organisms and their remains. (Roth, 1984) The **particles** in soil, on the other hand, are weathered from **non-living** bedrock. Weathering is the physical or chemical breakup of rocks through interaction with water in all its forms, oxygen and carbon dioxide. (Cvancara, 1985) The particles which result are assigned one of three classifications based on their size:

Sand (0.5 to 2 mm in diameter)
Silt (0.0002 to 0.5 mm in diameter)
Clay (under 0.0002 mm in diameter)

Sand grains are easily seen with the naked eye while silt particles are barely distinguishable and individual clay particles cannot be seen. Sand feels very **gritty** when touched; both silt and clay feel **smooth.**

Determining the particle sizes and the percentage of each in a soil sample represents an important way of classifying the soil. In this activity, your students will observe you suspending a soil sample in a jar of water and allowing it to **settle** to examine the types and relative abundance of particles present. Sand, the largest and heaviest of the particles, will settle first, followed by silt and clay in distinctive **layers**. Organic materials which are not completely decomposed will generally float to the surface of the water. Most of the particles will settle within approximately 30 minutes, but some of the clay particles can take more than a week to settle.

The particle composition of the soil is significant because it affects its ability to hold moisture and circulate air. Because of their large particle size, sandy soils (80% or more sand) drain quickly, making them susceptible to drought, but are generally well aerated. Clay soils (30% or more clay) can hold and retain more water but can also become water-logged and poorly aerated. The term "loam" is applied to a mixture of soil types which offers the best of both worlds. A good loam for growing plants might consist of 40% sand, 40% silt and 20% clay. (Vukasin, 1985). Most of the soils in Lucas County are loams of varying mixture.

BEFORE YOU GO

1. Introduce to your students the types and origins of soil particles as outlined in the background information, and allow them to examine the particles at the work stations which you have prepared. Distribute magnifying lenses to the students, and divide them into four groups. Assign each group to one of the work stations. Encourage the students to feel the texture of the particles between their fingers and look at them through the magnifying lenses. Discuss how the particles feel and look. Rotate the students through each of the work stations.

2. Explain to the students that soil is a mixture of different types of particles which determine its texture and that these particles can be sorted by suspending them in water and allowing them to settle. Discuss which particles they think will sink in water first and why. Accept all answers.

3. Demonstrate the sorting process by suspending a mixture of sand potting soil, clay and gravel in one of the large glass jars and allowing the particles to settle. Mix equal parts of the four particle samples in the empty aluminum pie pan. Fill the jar one-third full of the mixture, and fill the remaining two-thirds with water. Cap the jar, and shake it vigorously until the contents are thoroughly mixed. Set the jar aside to settle.

4. Instruct the students that they will be conducting a few tests to determine the texture of the soil in the Land Lab. The tests will include trying to form a ball or ribbon with the soil and sorting the particles in water. Have the students practice rubbing an imaginary ball between the palms of their hands and an imaginary ribbon between the tips of their thumbs and the sides of their index fingers. These are the motions used to make the soil tests. Distribute the metal spoons to the students, and take the remaining glass jar and the gallon milk jug of water with you. Go outside.

PROCEDURE

1. Make a large circle in the Land Lab with your class. Have the students clear a small patch of grass and dig in the soil with their spoons. In addition to sand, silt and clay particles, what do they observe? (They are likely to see rocks, small pieces of sticks and leaves, plant roots and soil animals such as earthworms, ants, beetle larvae and sow bugs.)

2. Have each student pick up a small clump of the soil from below the plant roots (15-20 cm/6"-8"). Moisten each sample with water from the milk jug. Instruct the students to use the palms of their hands to try and roll the soil into a ball and their thumbs and index fingers to try and rub the soil into a ribbon. Only soil containing a lot of clay and silt particles will pass these tests. Have the students describe the texture of the soil. Sandy soil will feel gritty while clay soil feels smooth. Based on their findings, have the students predict which particle will form the largest layer when the Land Lab soil is sorted in water.

3. Have the students add their soil samples to the large glass jar until it is approximately one-third full of soil. Add water from the milk jug until the remaining two-thirds of the jar is full. Cap the jar, and shake it until the contents are well mixed. Encourage the students to fill in their holes, including any remaining samples, and cover them with dead leaves and grasses. When all are finished, return to class.

CONCLUSION

1. Set the glass jar containing the Land Lab soil sample alongside the demonstration jar and allow it to settle. Give the students an opportunity to clean and dry their hands using paper towels. Look as a class at the demonstration jar that you prepared before going outside, examining the layers of particles which resulted. How does the known mixture of sand, potting soil, clay and gravel compare to the soil from the Land Lab? Were the students predictions about which particles would settle first correct?

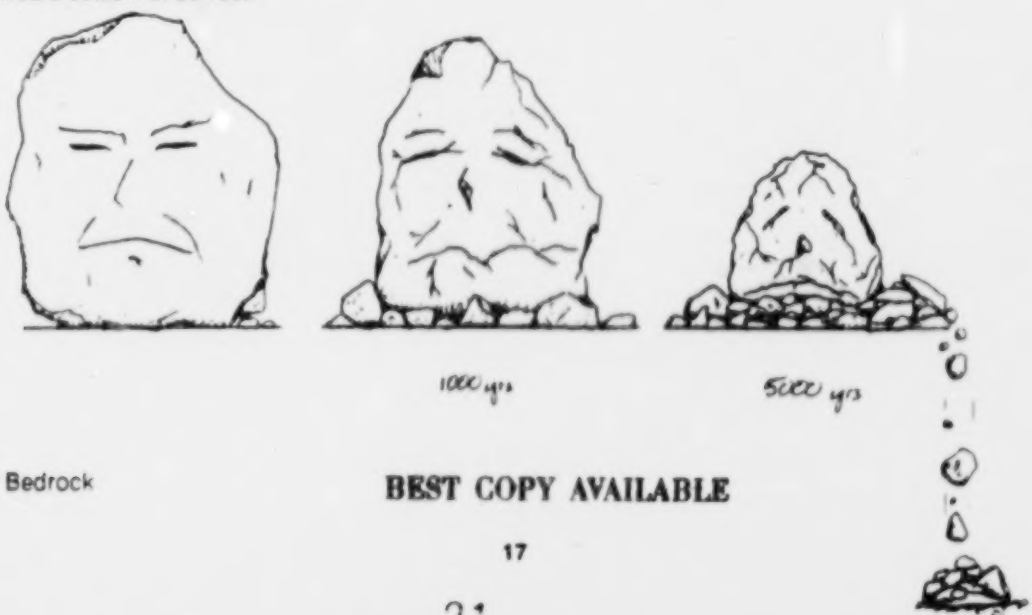
2. Remove the labels from the work stations which you prepared. Divide the students into four groups, and assign each group to a work station. Have each student feel the particle sample and give a word that describes what he or she is feeling without naming it. To challenge the students, do not let them repeat descriptive words. Can the students name the particles represented by the samples? Try the activity with the students blindfolded or rotating through the work stations, if time permits.

3. After 15 to 30 minutes have passed, give the students an opportunity to look at the layers of particles in the Land Lab soil jar again. Point out that remnants of living things generally float to the top of the water. Discuss the types of particles that they observe and the relative sizes of the layers. Did they correctly predict the largest layer based on their field tests? Place both jars on a shelf, and allow the students to periodically check them until the water appears clear. Return the soil to the Land Lab.

JOURNAL QUESTIONS

Put a strip of masking tape on the side of the Land Lab soil jar from top to bottom, and draw a line at the top of each layer of particles. Take the tape off the jar, and put it in your journal. Color the layers, showing the size of the particles in each, and label them with your teacher's help.

Draw a picture of yourself sampling the soil.



Weathering of Bedrock

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EXTENSIONS

1. **It's Alive!** Have your students try to find the parts of the soil that come from living things and plants and animals that live in the soil. How is this part of the soil made? (Dead plants and animals decompose, or break down, with help from animals, fungi and bacteria which use them for food.)

2. **Soil Profile.** Dig a deep hole in the soil and have your students describe the color and texture of the different layers that they observe. In which layers do they observe living things? (Most living things are found in the top layers of the soil where they can find lots of organic materials.)

3. **Rough, Rough.** Have the students bring in a variety of sandpaper from home. Use the sandpaper to demonstrate that particles of sand come in many sizes. Encourage the students to sort the sandpaper according to the size of its sand particles: from largest to smallest. Can they do this blindfolded? Have your students make their own sandpaper by gluing sand to heavy paper or thin cardboard. How does their sandpaper compare with the store-bought kind?

4. **Sorting It Out II.** Have your students observe varying sizes of sand by sifting a sample of sand through screens of different sizes. Which method of sorting particles do they like best? Why?

5. **Papa Was A Rolling Stone.** Demonstrate how rocks "create" soil by rubbing two pebbles together and letting your students examine the resulting particles.

REFERENCES/ADDITIONAL READING

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CHILDREN'S SCIENCE/TRADE BOOKS

Baylor, Byrd, author. Peter Parnall, illustrator. 1974. Everybody Needs A Rock. Charles Scribner. New York, NY. (TLCPL)
"No matter who you are, you need a rock. However, there are ten rules to follow in finding the one which is perfect for you."

Ryder, Joanne, author. Dennis Nolan, illustrator. 1990. Under Your Feet. Four Winds Press. New York, NY.
"This book explores the animal world which exists under the earth in a series of poetic questions addressed to the observant child."

Webb, Angela, author. Chris Fairclough, photographer. 1986. Talkabout Sand. Franklin Watts. London, England. (TLCPL)
"Describes the origins and characteristics of sand and includes activities for exploration."

Soil Compaction
Puddles Under The Swing Set

GRADE LEVEL/TOPIC: K-1/Soil

TIME REQUIRED/RECOMMENDED SEASON: 60 to 90 minutes/Spring or Autumn

SCIENCE SKILLS: Observing, Comparing, Predicting

KEY WORDS: Land Use, Compaction, Vegetation, Air Space, Absorb, Puddle, Runoff

OVERVIEW
This Activity examines how compaction of the soil affects its ability to absorb water. It consists of an indoor demonstration of compaction (15-30 minutes), an examination of land use and field testing of the ability of soil to absorb water in the Land Lab and in the surrounding park (30-45 minutes) and a follow-up demonstration featuring how aeration of the soil changes it (15-30 minutes). This Activity may be divided into shorter sessions to accommodate your time allocation for science. If this is your first trip to the Land Lab, please consult the Introduction.

PURPOSE
1. Students will observe that well-aerated soils, like those found in the Land Lab, absorb water faster than other areas of the park.

MATERIALS
For The Class:
- Clear, wide-mouthed plastic container
- Potting soil or peat moss (2 cups)
- 8-centimeter (3-inch) strips of masking tape (2)
- Permanent black marker
- Cup of water in clear container
- Wooden spoon

For Each Student:
- Gallon milk jug, half-filled with water

Prepwork
Have your students bring in gallon milk jugs from home until there are enough for one per student. Write "before" and "after" on two strips of masking tape with permanent black marker. Fill the plastic container with potting soil or peat moss half to three-quarters full, and mark the level of the soil with the "before" tape. Fill the gallon milk jugs half full with water. Gather other necessary materials.

BACKGROUND INFORMATION
The land in your schoolyard and the park is heavily used by people. Many **land uses**, including foot and vehicular traffic, affect the soil by pressing its particles together. This process, known as **compaction**, results in soil which is physically harder and nearly devoid of air spaces. (Hunken, 1994) Clay soils are more susceptible to compaction than are sandy ones.

Compaction generally occurs in relatively small areas along established trails or in playing fields. These compacted areas can be readily recognized by the absence of most types of **vegetation**, or plants. The roots of most plants cannot thrive without adequate **air space** in which to grow and breathe. (Hunken, 1994)

In this activity, your students will use the ability of soil to **absorb** water, or take water into its air spaces, as an indicator of compaction. The reduction in air space caused by compaction affects this ability. Without air spaces to fill, rain on compacted or paved areas either **puddles** at the surface or **runs off**, carrying the exposed soil with it. Erosion is the reason that most paths and heavily used areas are lower than the level of the surrounding soil.

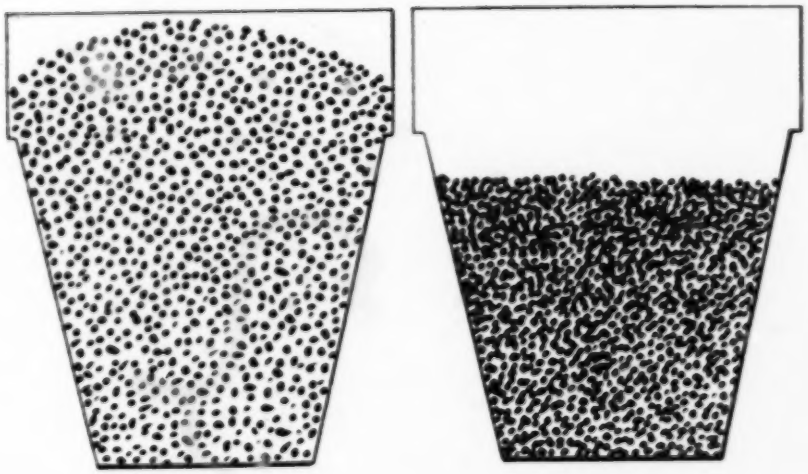
In your Land Lab, erosion is discouraged by the well established vegetation. The absorption of water is encouraged by the action of worms, moles and other soil-dwelling animals which create air spaces where water can be held until it is used by plants.

BEFORE YOU GO

1. Explain to your students that they will be exploring one of the ways that our use of the land affects the soil. Describe compaction and its effect on soil as outlined in the background information.

2. To demonstrate compaction, show the class the plastic container of potting soil or peat moss, indicating the "before" level of the soil. Pass the jar around the room, giving each student the opportunity to try packing the soil with his or her fist. When all students have had a turn, mark the new level of the soil with the "after" tape. Discuss what has happened. Reinforce that compaction makes it difficult for the soil to absorb and hold water, and this, in turn, makes it difficult for plants to grow.

3. Have the students name different kinds of activities that might compact the soil. Encourage the students to look for areas of the park that are used for these activities. Divide the students into groups of two, and give each student a milk jug half-filled with water to carry. Go outside.



Soil Compaction Demonstration

PROCEDURE

1. Lead your students on a tour of the park, identifying areas of heavy use: baseball diamond, swing set, parking lot, sidewalk, corner cuts, etc. How can the students tell that these areas are compacted? (They are lower than the surrounding areas and have no plants growing on them.) Have half of the students take turns pouring their water onto the paved and compacted areas while their partners count "One-COMPACTION, two-COMPACTION..." until the water is absorbed. Allow at least a count of ten for students to observe that water will not be absorbed in paved areas. Discuss what happens to the water.

2. Lead your students on a tour of the Land Lab, looking for signs of better aerated soil: mole tunnels, worm castings, dense vegetation, etc. How have air spaces been added to these areas? (The digging and tunneling of the animals have added air spaces.) Have the remaining half of the students take turns pouring their water onto a variety of areas while their partners count. Discuss what happens to this water. When all students have emptied their water jugs, return to the classroom.

CONCLUSION

1. Review with your students their observations of compacted and well-aerated areas of the Land Lab and what happened to the water poured on each area.

2. Hold up the plastic container of compacted potting soil, and ask your students to predict what will happen if you add water to the container. Will it puddle on top or be absorbed into the soil? Add water to the plastic container to test their prediction. (It should form a puddle on top.) Pour off any excess water into a clear container, and show it to the students. Is the water clear? Explain that the muddy water illustrates the way that runoff erodes soil from compacted areas.

3. Add a wooden spoon to the plastic container. Pass the container around the room, giving each student an opportunity to try stirring the soil and returning it to its "before" level. Explain that the students are doing the work of animals such as earthworms and moles which add air spaces to the soil. When all students have had a turn, compare the new level with the "after" level. Have the students predict what will happen if you add water to the container a second time. Add water to test their prediction. (It should be absorbed into the soil.)

4. Discuss with your students any suggestions which they might have for reducing the amount of compaction in the park. How will reducing compaction improve the park? (It will improve the appearance of the park, reduce erosion and the number of puddles after a rain and make the park a better habitat for plants and animals that live in the soil.)

JOURNAL QUESTIONS

Draw a picture of a place in the park that has compacted soil and a place in the park where the soil has air spaces. Draw water in each picture to show what happens when it rains on compacted soil and soil with air spaces. Circle the place that absorbs water faster.

EXTENSIONS

1. **Give Me Air!** Have your students draw a picture of animals adding air spaces to the soil. Then have them design ways that they can add air spaces to compacted soil in the park. If materials available and safety permit, allow them to try their ideas. Pour water over the compacted area before and after treatment to test their success.

2. **How Hard Is It?** Have your students test for compaction by pushing pencils or sharpened popsicle sticks/tongue depressors into the ground with the palms of their hands. Have them test soil in the Land Lab and in more compacted areas of the park. Mark the pencil or stick after each test for comparison. How do the areas tested compare?

3. **A Piece Of My Backyard.** Have each student bring in a cup of soil from home, and have your class compare the soil types. Allow them to examine how the soils look, feel and smell. Instruct the students to try to compact their soil sample by pushing or squeezing it. Do some soils compact more easily than others? (Clay soils compact most easily; sandy soils are more difficult to compact.)

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Splatter Testing With Soil
Keeping It Together

GRADE LEVEL/TOPIC: K-1/Soil

TIME REQUIRED/RECOMMENDED SEASON:
45 minutes/ A calm (not windy day) Autumn or Spring

SCIENCE SKILLS: Observing, Comparing

KEY WORDS: Erosion, Soil, Decomposition, Vegetation

OVERVIEW
In this Activity, the students will be introduced to the concept of erosion (10-15 minutes) and use targets to see the effects of erosion (30 minutes). Feel free to break this lesson up into smaller parts. If this is your first Activity, please consult the Introduction.

PURPOSE
1. Students will observe the ability of water to displace soil and will measure that displacement with a ruler.

2. Students will observe that vegetation reduces the effects of water erosion.

MATERIALS
For The Class:
- Shovel
- 5-gallon buckets, or other large containers (3)
- Soil Target Master
- Optional: 1/4 cup measuring cup
- Sheets of newspaper(3)

For Each Pair Of Students:
- Eyedropper
- Soil, about 125 cc (1/2 cup)
- Handful of dead grass
- Soil Targets (2)
- Crayons

Prepwork
Photocopy two soil targets for each pair of students. Use the shovel to fill one bucket about one-fourth to one-third of the way with soil from the Land Lab. Repeat the process to obtain dead grass or leaves to use as vegetation. This activity works best if the soil is allowed to dry out a bit on some newspaper overnight. Advise students the day before to "dress down" for this Activity.
Optional: Using small plastic baggies, bag up the soil and dead grass for students ahead of time.

BACKGROUND INFORMATION
Erosion is the movement of **soil** by water or wind. Soil is made by the **decomposition** of dead organic material such as plants and animals (for more information on soil formation, see the Soil Making/Composting Activity for grades 4-6). This usually happens in a forest setting. Erosion is a problem because it removes topsoil, the fertile soil in which plants (such as food plants) grow best. With the disappearance of the fertile topsoil, farmers need to put chemical fertilizers on their crops to make them grow. These chemical fertilizers can get washed into waterways, upsetting the natural balance of nutrients in a stream or river.

PARK - IT!

K-1

When erosion occurs in our area, soil is usually washed into rivers and streams by rainwater. Soil suspended in water can have detrimental effects on the life around a waterway. Most people have seen trees that are on a bank of a river or stream and have had most of the soil washed away from their roots. When too much soil is washed away, the tree falls into the waterway. Also, muddy water blocks sunlight that aquatic plants need to photosynthesize (make food for themselves). Without sunlight, these plants die, and the animals that depend on them for food are in jeopardy. The fine sediments in muddy water can clog the gills of fish and interfere with their breathing. For predatory fish that rely on their keen eyesight to find food, sediment-laden water can make hunting difficult.

One way to reduce the loss of soil due to erosion is to plant vegetation in erosion-prone areas. Planting **vegetation** such as willow help to slow down the flow of water and filter the soil out of rainwater before it goes into a waterway.

This activity was adapted from an activity guide titled, "On the Trail of Nonpoint Source Pollution" by the Butler County (Ohio) Department of Soil and Water Conservation.

BEFORE YOU GO

1. Ask students to imagine a forested hillside. Now imagine that all of the trees were cut down, leaving nothing but bare ground. Ask students what effects this would have on wildlife in the area. Now imagine that it is beginning to rain. Lots of rain. Where would the water go? What would the water look like when it reached the bottom of the hill? Hopefully, the students will say that the water would be muddy. Feel free to illustrate this exercise on a flannel board or chalkboard. Establish that erosion is occurring when water carries soil from its place on the ground into a waterway.

2. Tell the children they will be doing an activity where they will try to make erosion happen. Divide the students into pairs and distribute two targets per pair. Have students color targets, if desired. Optional: If there are enough eyedroppers to go around, this activity can be done individually.

3. Note that the distance from the center circle is on the target. This is to allow the children to measure how far the dirt moved as a result of the water dropped on it. This tends to be a messy activity and is best done outside. If it is not windy, the Land Lab is a great place.

4. Divide students into pairs. Give each pair a cup with some water in it and one eyedropper. Let students take turns practicing how to use the eyedropper.

5. Fill the third (empty) bucket about one-third to one-half way with water. Take class and buckets of soil, vegetation and water outside. Optional: If desired, bring a few crayons outside so children can mark how far the water moved the soil on their targets (see Procedure #7.)

PROCEDURE

1. In the Land Lab, instruct each pair of students to lay out their targets on a flat surface. To secure the target, instruct one student to stand on two corners of the target.

2. Put about 1/4 cup (63 cc) of dry soil in the middle of each target. Each pair should have two targets with an equal amount of soil on them. Cover the soil of one target from each pair with a handful of dead grass or other vegetation.

3. Pass out eyedroppers. Instruct the students with the droppers to go to the bucket with water in it and fill their dropper.

4. Instruct the student with the dropper to stand over the target without vegetation. The student then proceeds to drop, one drop at a time, water on the pile of soil, trying to move the soil. Students should start with the eyedropper at about shoulder height, and can vary that height to see if it increases or decreases the distance the soil splatters.

5. When eye droppers are empty, have children switch roles, get another dropperful of water and repeat step three on the target with the vegetation over it. If desired, have each student use more than one dropperful of water before switching roles.

6. Help students find out how far the soil went by reading the measurements from the target's center. Walk around and observe several pairs of targets to be able to note trends.

7. When finished, have students dump the soil and vegetation into their respective buckets and return these materials to the Land Lab. If desired, have students mark how far the soil on their target went with a crayon. Bring targets and equipment back to classroom.

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CONCLUSION

1. Discuss which target, the one with bare dirt, or the one with vegetation, had the soil going the farthest from the center. (The target without vegetation should have the biggest "splatters".) Does dropping the water from higher up cause the soil to go farther from the center of the target? (It should, because it will be going faster).

2. Discuss the implications of this activity by asking the following sorts of questions. If a farmer had a field of bare dirt, could rain water wash away some of that bare dirt?(yes, this can and does happen, leading to the necessity of adding chemical fertilizers.) What could happen if a farmer lost all of his/her topsoil? (He/she would have a hard time growing food.)

JOURNAL QUESTIONS

Draw a picture of soil washing away from a hill and going to a river.
Draw how animals such as fish, are effected when muddy water washes into a stream.
Draw a picture of a plant's roots holding onto the soil in your Land Lab.

EXTENSIONS

1. **The Real Thing.** If there is a drainage ditch close by, or some other place at which to see the effects of erosion, take the class there.

2. **A Fish Named Fred.** This is another activity from the Butler County (Ohio) Department of Soil and Water Conservation. Start with a plastic spoon, a sponge cut into a fish shape, or a plastic fish. Attach to this a string or pipe cleaner. This is Fred. Have a glass fishbowl or aquarium and dangle Fred in several inches of water. Gather the following materials: coffee grounds or dirt for dirt, about two tablespoons of dish soap for effluent pollution, salt or sugar for road salt, small bits of paper for litter and food coloring for nuclear waste. Introduce Fred to your class and tell them they are going to pretend that Fred is a fish in the Ottawa (or whatever) River. Furthermore, your class is going to follow Fred as he travels downstream. Using one item at a time, tell the class what Fred encounters (dirt, road salt, litter, soapy effluent pollution and nuclear waste) as he tries to get to Lake Erie. Then select one student to pour that item in with Fred. After each item is added, ask your class, "How is Fred feeling?" The point of this activity is to show how fish (and other wildlife using our waterways) have no control over the actions of people, and can be subjected to all sorts of pollution. Ask the students if they would like to eat a fish like Fred. It is important to know that some forms of pollution (such as heavy metals) are hard to detect.

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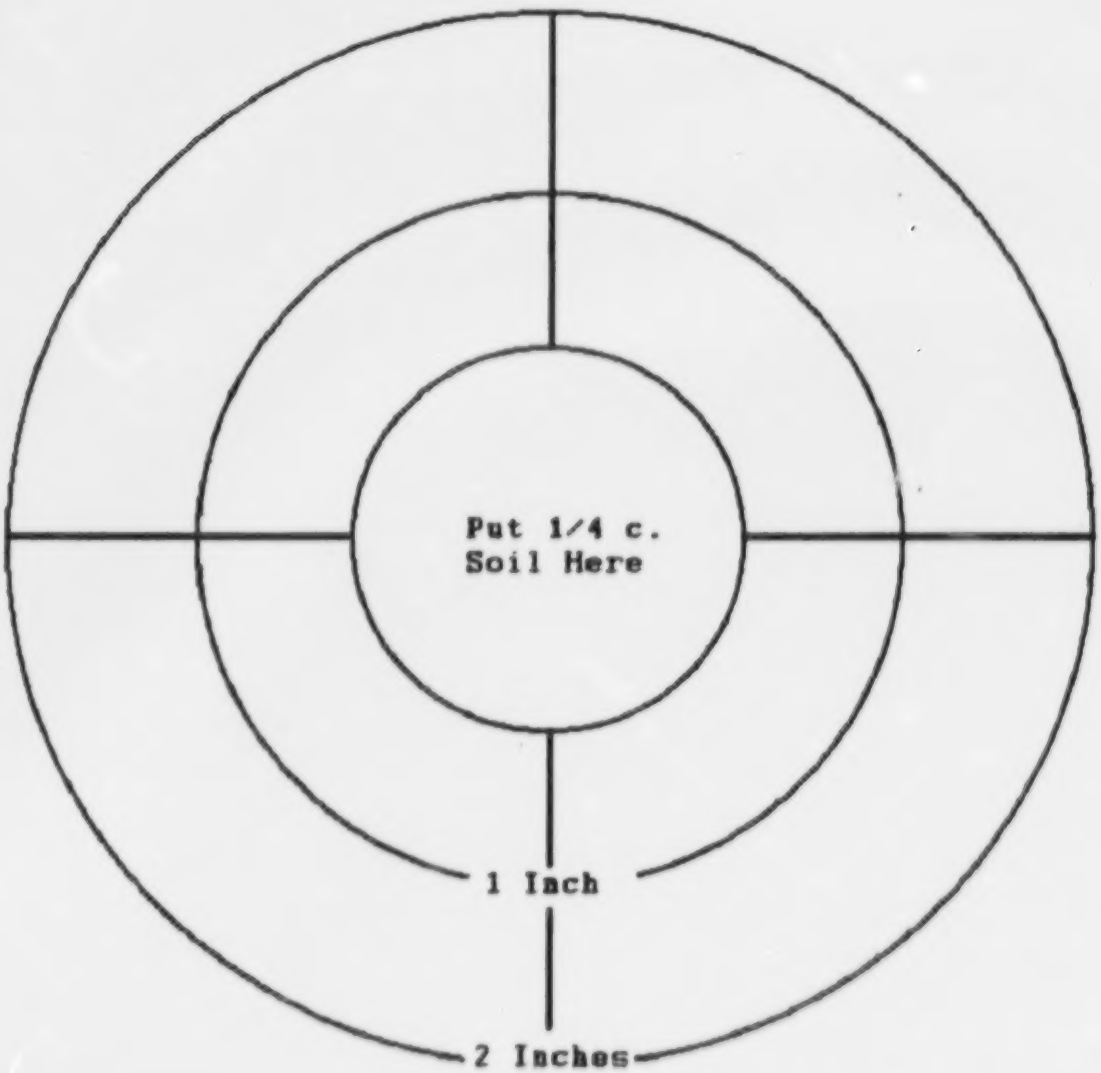
Soil Target (Splatter Testing)

Names _____



Evaporation
Which Way Did It Go?

GRADE LEVEL/TOPIC: K-1/Water

TIME REQUIRED/RECOMMENDED SEASON: 90 minutes. This includes two 30 minute periods several hours apart/a warm day in either Spring or Autumn

SCIENCE SKILLS: Observing, Hypothesis Testing, Questioning.

KEY WORDS: Water Cycle, Evaporation, Precipitation, Condensation, Sublimation, Heat, Wind, Solid, Liquid, Gas

OVERVIEW

In this Activity, students will explore the water cycle by observing the effects of the processes of evaporation and condensation. They will participate in a demonstration involving ice, water and steam (20-30 minutes). Also, they will be allowed to fill a cup with water, choose an "evaporation location" (20-30 minutes) and come back at the end of the day to check their results (20-30 minutes). The rate of evaporation will be affected by wind, the color of the surface upon which the cup is placed and the outside temperature. If this is your first Activity, please consult the Introduction.

PURPOSE

1. Students will be able to observe and state that water has three forms (solid, liquid, gas) and can change from one form to another.

2. Students will name some factors that affect the rate of evaporation.

MATERIALS

For The Class:

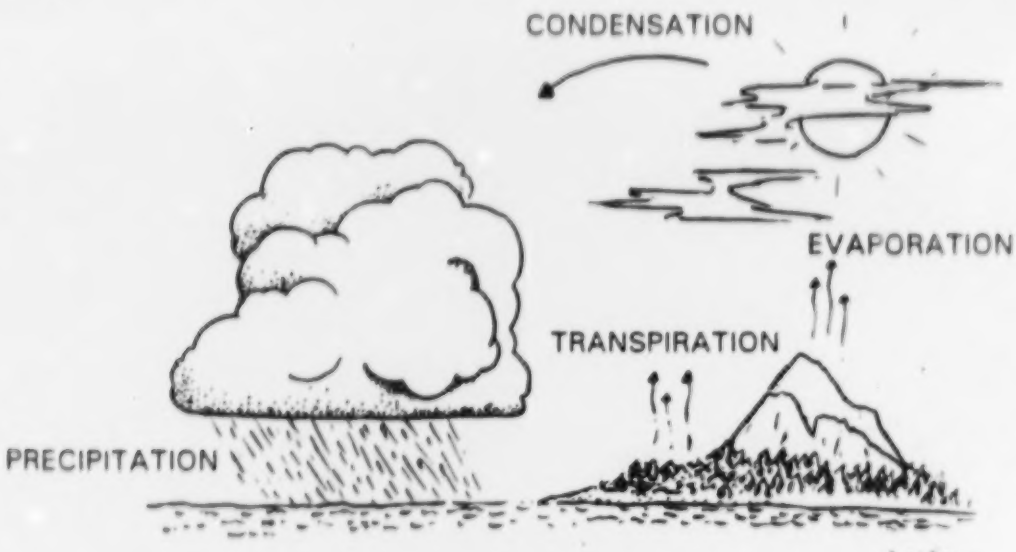
- Measuring cup or graduated cylinder
- Bucket or milk jug of water
- Permanent marker
- Hot plate
- Ice
- Metal can (empty), such as a small coffee can or a soup can
- Clear plastic "party cups" for demonstration (2)

For Each Student:

- Clear plastic "party cup"

Prepwork

Procure one, one-cup clear plastic "party cup" for each student (see Data Sheet). Use the permanent marker to label the 1/2 cup mark on each cup. Add students' names to cups if desired. Optional: Have students work in pairs or small groups instead of individually.



BACKGROUND INFORMATION

Water comes in three physical forms: **solid** (ice), **liquid** and **gas** (vapor, steam). The order of the molecules in each of these forms ranges from chaotic in gases to very ordered in solids. The same is true for substances other than water. The water in our environment changes seasonally between these forms as a result of the sun and the earth's tilt towards or away from the sun.

During the winter months, water in the form of ice makes life especially difficult for wildlife. Many animals have difficulty finding liquid water, and most plants go dormant. Having adequate amounts of unpolluted fresh water is becoming a major issue in water-poor areas of the world. Even in this country, humans use more and more fresh water every year, while the sources of fresh water become dirtier and more scarce.

Water is important to all life. We humans use water for agriculture, drinking, cleaning our clothes and ourselves, cooking, industry, houseplants, pets and more. Water is a renewable resource, but there is only a finite amount. This apparent contradiction is the result of the **Water Cycle**. The Water Cycle consists of the processes of **evaporation, condensation** and **precipitation**. This cycle is driven by energy from the sun. Water evaporates (changes from a liquid to a gas) from bodies of water such as lakes, rivers and oceans. Certain factors such as heat, wind and dark colors can speed up the rate of evaporation. Water is in the form of vapor at this point, so we can't see this happening (although we can see the results). Once in the atmosphere, molecules of water in the form of water vapor collect together in a process called condensation. When the collection of water molecules gets too big to fight gravity, a droplet falls to earth as precipitation. Of course the whole phenomenon of weather is more complicated, mostly because of the differential heating of surfaces on the earth. But part of the water cycle can be explored by this age group by setting up an experiment to allow water to evaporate.

BEFORE YOU GO

1. Demonstrate the change from solid to liquid by putting some ice into the metal coffee can and passing it around for the students to observe. Try to start with little or no liquid water in the cup. What is happening to the ice as it is passed around? If you breathe on the ice, what happens? (The heat from your breath causes some of the water to go directly from a solid to a gas, a process called **sublimation**.) Ask your students to predict how the ice would change if left alone for several hours. Is there anything your students could do to speed up the melting process? Is there anything on the outside of the can? (Temperature differences between the outside of the can and the surrounding air causes water to condense out of the air onto the can.) Where did that water come from? Does this mean there could be water in the air? Breathe on a piece of glass or a mirror to find out.

2. Next, demonstrate water changing from a liquid to a gas by placing the coffee can with the ice and water in it on a hotplate. While you are waiting for the ice to finish melting and begin to boil, discuss with your class the things that make water change to ice or to steam. Optional: You can save part of the labeling of the cups for this part of the lesson. Observe the boiling water. Where does the water go? To show another example of evaporation, have each student lick the back of their hands and then blow on them. The heat from their bodies and the force of their breath provides enough energy for the molecules of water to go from a liquid to a gas. Furthermore, the cool sensation they feel comes from losing just a little bit of body heat in the process. Ask your students to predict what would be in the coffee can if the water boiled for several hours. (The water in the can would eventually boil dry.)

3. Ask the students again what kind of things caused water to go from a solid to a liquid and from a liquid to a gas. Answers should include heat and wind. Tell students that they will be trying to find a good place in the Land Lab for water to evaporate. One other influence will be the type of surface their cup is set on. Explain that dark colors get hotter than light ones. This is obvious if one has ever gone outside on a hot sunny day with a black shirt on! Finally, explain to the students that they will place their cups and check on them at the end of the day. This experiment is best done in the Land Lab, but you can place cups on parking lots and other locations to get more dramatic effects.

4. Gather cups, bucket or jug of water and take class outside.

PROCEDURE

1. When the class arrives at the Land Lab fill all cups up to the line if you are using a jug. If you are using a bucket, instruct students to carefully fill their own cups up to the line.

2. Suggest several places where the students can place their cups (by a fencepost, in the shade, in the sun, under some grass, on the path, etc.). Instruct children to choose a location and position their cups. Ask children why they picked their location and to predict what will happen to the water in the cup.

3. On your way back to the classroom, stop at two or three locations outside the Land Lab, such as a parking lot or windy corner of the building. Place 1-3 "demonstration" cups in these locations.

4. Later in the day (5 hours if possible), bring class back to the Land Lab. Optional: If there is no chance of rain, leave cups out overnight. Bring the permanent marker with you to mark the new water levels in the cups. Are the students' locations still good for evaporation? (Are they in the shade now?) Instruct students to observe how much water has evaporated by comparing the water level to the line drawn on the cup.

5. Mark the new water line on each student's cup. Have students dispose of their water by pouring it at the base of a tree.

6. Check the two or three demonstration cups, mark their water levels, empty the cups and bring them inside.

CONCLUSION

1. Discuss the class' findings. Which container of water evaporated the most? The container in the sun? The dark surface? The shade? How could the students tell that some of the water had evaporated? Did the wind affect how much water evaporated?

2. On the Data Sheet, have students draw the water level before and after some of the water had evaporated. Also, have them draw conditions in the Land Lab under which the most water would evaporate (i.e. a hot, sunny, windy day).

3. Does evaporation happen to lakes and rivers? Where does the water go?

JOURNAL QUESTIONS

Draw the three forms of water you saw in class.
Draw examples of three forms of water that you could see in nature.

EXTENSIONS

1. **Another Condensation Demonstration Situation.** One variation of this Activity is to cover one or more cups with clear plastic food wrap. One can then discuss why the water is on the plastic, and how it was not able to escape - it's kind of like a water cycle in miniature.

2. **Paint It Black.** Another variation is to paint the outside of the cup black or white to accelerate or slow down the process of evaporation.

3. **The Water Cycle Relay Race.** This is a relay race where students use cups to empty one bucket (labeled "river") and to fill another (labeled "clouds"). Students then repeat the process and make it "rain" by filling the "river" with water from the "clouds".

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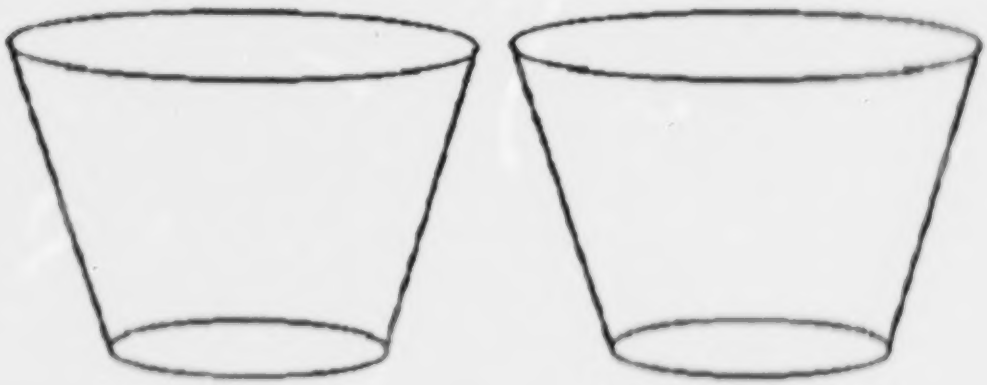
DEPARTMENT OF NATURAL RESOURCES

DATA SHEET
EVAPORATION

Name _____



Draw a line on the cups to show the water level in your cup before and after you put it outside.

Draw a day in the Land Lab when there was a lot of sun and wind.

Transpiration

Plants Don't Sweat, They Transpire

GRADE LEVEL/TOPIC: K-1/Water

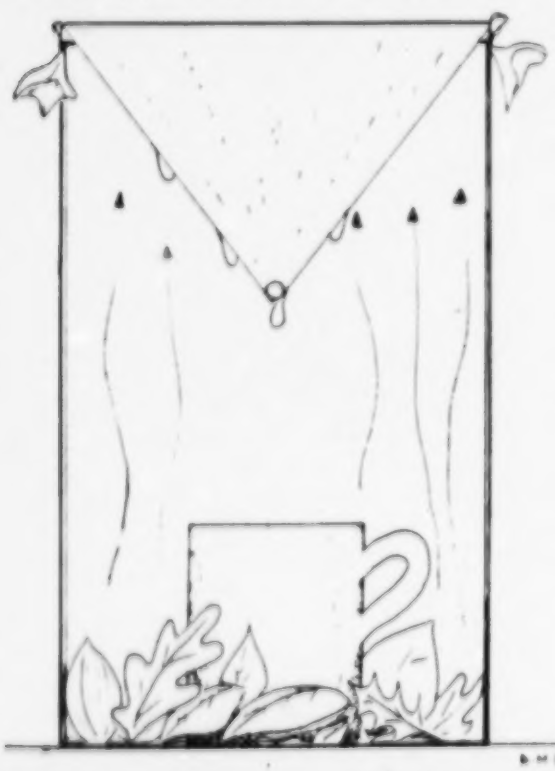
TIME REQUIRED/RECOMMENDED SEASON: 65 minutes with a day or two wait between lessons / A sunny day in Late Spring or Early Autumn (when there are still green leaves on the trees)

SCIENCE SKILLS: Observing, Predicting, Model Building

KEY WORDS: Transpiration, Solar Still, Leaves, Roots, Stem, Branches, Stomata, Food Chain, Xylem, Photosynthesis

OVERVIEW

In this Activity, students will be introduced to the process of transpiration in plants through two demonstrations (20 minutes prep time, a day or two wait and then 10-15 minutes for observation). The class will help set up an experiment in the Land Lab using two solar stills(30 minutes), and return several hours later to observe the results (20 minutes). Finally, the students will use a handout to trace the path of water through a plant (10-20 minutes). If this is your first Activity, please consult the Introduction.



PURPOSE

1. Students will demonstrate that living plants give off water by constructing a simple solar still.

2. Students will trace the path of water through a plant.

MATERIALS

For The Class:
- Masking tape
- Small weights, such as marbles or small stones (2)
- 5-gallon buckets (2)
- Plastic containers with lids (2)
- Clear plastic wrap

Optional, for Demonstrations:
- leafy stalk of celery
- white carnation
- 2-3 glasses of water
- 1-2 colors of food coloring
- paring knife

For Each Student:
- Zip locked bag
- Water in Plants handout
- Set of crayons or markers

Prepwork

One way to demonstrate how water moves through a plant is by using colored water and a white carnation or a leafy stalk of celery. A day or two before you wish to show this demonstration to your class, make a fresh angled cut on the stem of the carnation or celery. Place it in water with about 10 drops of food coloring and put in a sunny window. After a day or two, cut the celery in 1/2" slices and pass out to students. By looking at these slices, students can see that the dye has been taken into the plant with the water. Similarly, the dye moves up the stem of the carnation with the water to color the blossom. If you want to get really fancy, make the cut on the stem of the carnation and then split the stem vertically into two equal halves that are still connected for several inches below the flower. Put each half of the stem in a differently colored glass of water. This produces a bi-colored flower.

Procure two plastic containers with lids, such as margarine containers. Photocopy one Water in Plants sheet for each student. Set up one solar still (See Procedure #4) as a demonstration to show students.

BACKGROUND INFORMATION

Plants are unique living things because they use the sun's energy to put carbon dioxide and water together to make food for themselves, a process called **photosynthesis**. The basic parts of a plants are, from the bottom: **roots, stem, branches** and **leaves**. Plants are the basis for many **food chains**, meaning that many animals eat plants and are then eaten by other animals. Examples of simple food chains are the following (the arrows represent the transfer of energy from one level of the food chain to the next).

acorns → squirrels → hawks

seeds → mice and → foxes

Also, all of the things humans eat, either directly (like vegetables) or indirectly (like beef that eats grain) come from plants. Thus, recognizing the connection between plants and living things is important.

Plants take in water through their roots and use that water in all parts of the plant. This is sort of like the circulatory system in people with one important difference. In plants, the water goes on a one-way trip through the plant and is not recycled, like water and blood are in people. Plants have water-conducting tubes, collectively called the **xylem** (this is pronounced ZY-lum), through which water travels from the roots to the leaves. There is no mechanism for transporting water through the plant. Water has a property called surface tension, meaning it tends to stick to itself and behaves rather like the links of a chain. As a result of one bit of water being evaporated from the leaves, another is pulled in through the roots.

In the food-making, or photosynthetic, process carbon dioxide enters the plant from the atmosphere. Again, there is no active mechanism to "pull" this gas into the plant. To get the required amount of carbon dioxide into them, the **stomata** (tiny openings on the underside of the leaves) need to be moist. As one might suspect, water is lost to the simple process of evaporation here. Therefore, a plant uses vast amounts of water to 1) get carbon dioxide and 2) pair that carbon dioxide with water during photosynthesis to make food.

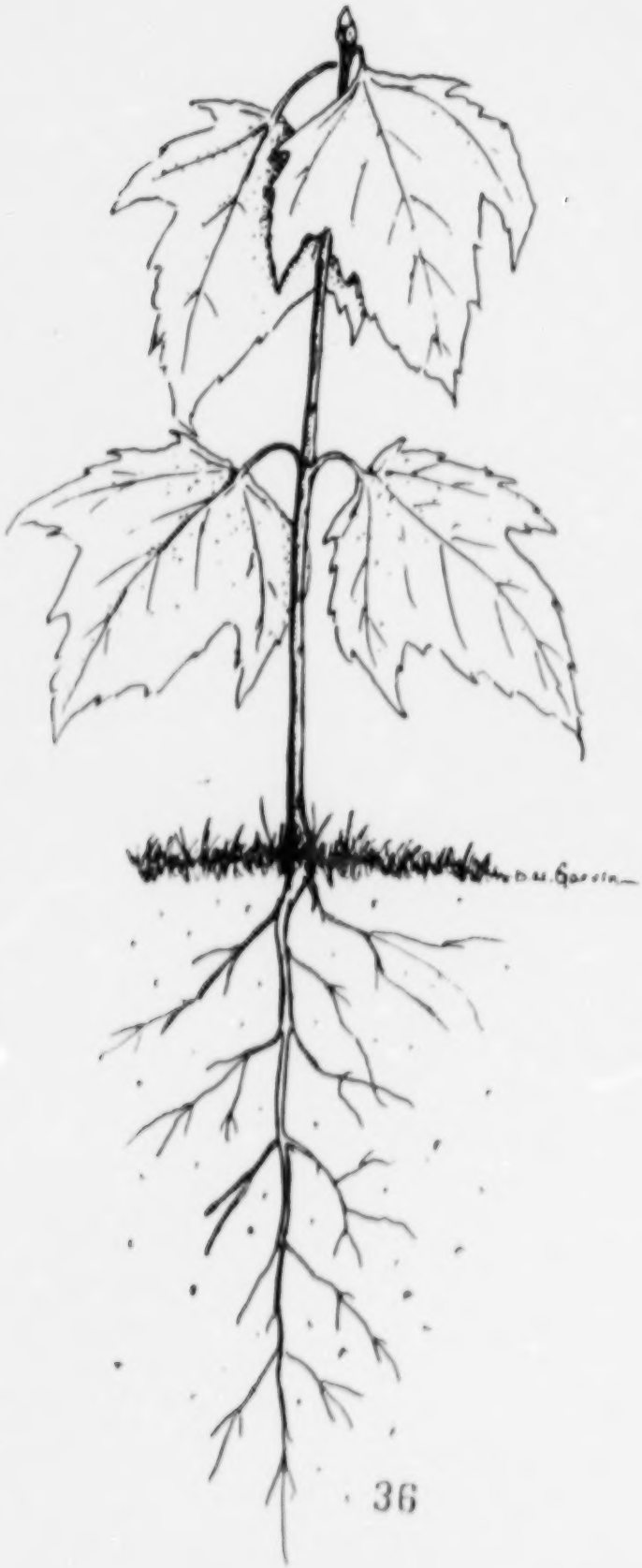
The process by which water evaporates from the leaves of a plant is called **transpiration**. We cannot see the water because it is in the form of vapor. A fun fact is that a tree loses to transpiration 90% of the water taken in by its roots. For even a medium sized tree, this can translate into hundreds of gallons on one warm summer day! When one considers the number of trees in our city, or in the world for that matter, one can see the connection between trees and the water cycle. Trees contribute vast amounts of water which finds its way up into the atmosphere and then comes back down to earth as precipitation.

Transpiration's end product, water, is easy to see from this simple experiment. Most people do not realize the capacity of plants to move lots of water through their tissues. Students this age should be able to understand that water enters plants through the roots and exits via the leaves.

In keeping with the idea that use of the Land Lab should not be consumptive, you will be using clumps of sod (soil, grass and roots) for this Activity. Afterwards, the sod can be replaced on the spot it came from.

WATER IN PLANTS

HANDOUT



BEFORE YOU GO

1. Introduce plants as living things that can make their own food. Using the Water in Plants handout, show students the different parts of a plant. Use the illustration also to show students that water moves through the plant on a one-way trip from the roots through the leaves.

2. Show students the results of the celery/carnation demonstrations.

3. Your class should now at least begin to realize that plants contain water and that it moves through their tissues. Explain to students that they will be doing an experiment to find out if plants store and give off water. Also, explain that they will be using both living and dead plants and seeing which has more water.

4. Show the class a solar still which you have assembled. See Procedure #4.

5. Distribute equipment (2 buckets, 2 containers with lids, clear plastic wrap, masking tape, small weights) and go outside.

PROCEDURE

1. Set equipment in a sunny part of the Land Lab and point out different kinds of plants. There should be grasses, trees and forbs (plants with showy flowers). Show your class the different parts of a plant, pointing out that they can not see the roots because they are underground. Use the shovel to dig up several small clumps of sod and show students the fibrous root system of a grass.

2. Place the clumps of sod in one of the buckets. Position clumps green-side-up, such that the container will fit in the center of the bottom of the bucket.

3. Instruct students to each get a handful of dead (brown) grass or leaves and place it in the other bucket.

4. Place an uncovered container in the center of the bottom of each 5-gallon bucket. Cover the bucket with clear plastic wrap and secure wrap with masking tape. Place the small weight in the middle of the wrap so it sags slightly and the water collected by the still will drop into the container.

5. Ask students to predict what will happen in each bucket.

6. Position the stills so they will receive several hours' worth of sunlight and return to the classroom.

7. Several hours later, return to the Land Lab to check the results of this experiment. Place covers on the containers. Return clumps of sod to where they belong, explaining that you are doing this so the grass can continue to live. Bring class and rest of equipment back to the classroom.

CONCLUSION

1. With both containers available for students to observe, ask the students the following kinds of questions. Did both of the containers end up having water in them? (The one with the brown grass should not.) Why does the 'live grass' container have water in it? (Because water from inside the plants moved from the roots to the leaves and out of the plant, collecting on the plastic.) What does the water in the containers look like? Is it colored? Does it have anything else (like insects) in it? What does it smell like?

2. Have students compare the water from the stills with the water from a faucet. Is it drinkable? (Probably, but it is best not to because of chemicals on the grass or in the soil.)

3. Hand out a Water in Plants handout to each student, along with some crayons. Have students color the handouts and trace the path of water through the plant.

JOURNAL QUESTIONS

Put completed handout in your Journal.
Draw a picture of a plant you saw today. Include all of its parts.

EXTENSIONS

1. **Still Another Still.** This experiment can be modified such that each student can make his or her own solar still. Distribute two zip locked baggies to each child, and have him or her fill one bag half full of green grass and the other half full of brown grass. The water produced will be a bit more difficult to drain off, but each child can look at it inside his/her own baggie.

2. **It's A Wrap.** Another simple way to demonstrate that plants store and give off water is to use the plastic wrap on living grass. Secure a piece of plastic wrap over some grass and return in several hours to observe the condensation on the plastic wrap. Grass treated this way will die if left "wrapped" for more than a couple of days.

3. **Just Bag It.** Hand out a zip locked bag to each student with the following assignment. Students should go home and zip the baggie around a leaf on a tree in their yard or on a houseplant leaf. Have them get an adult's help. Students should leave the baggie on for at least one hour. When the baggie is retrieved, the students should notice that there is indeed water in the bag and that the water comes from the same process they talked about at school that day.

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Brenner, Barbara and May Garelick. Fred Brenner, Illustrator. 1979. The Tremendous Tree Book. Boyds Mills Press. Honesdale, PA. (TLCPL)
"Told in simple rhyme, these verses celebrate the marvels of trees."

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Plant Parts

Look, Ma, No Hands!

GRADE LEVEL/TOPIC: K-1/Plants

TIME REQUIRED/RECOMMENDED SEASON:
90 minutes can be divided over several days / Autumn

SCIENCE SKILLS: Observing, Record Keeping, Comparing, Drawing, Matching

KEY WORDS: Leaf, Flower, Seed, Fruit, Nut, Alike, Different, Compare

OVERVIEW

This Activity introduces plant parts, including leaves, flowers, seeds and fruits, through the matching of drawings with actual examples in the Land Lab and/or surrounding park. It consists of a plant part matching game in the classroom (10-20 minutes), a scavenger hunt in the Land Lab (20-30 minutes) and a follow-up activity, coloring the plant parts (10-20 minutes). Feel free to break this Activity into smaller lessons. If this is your first trip to the Land Lab, please consult the Introduction.

PURPOSE

1. Students will be able to match illustrations of plant parts with illustrations in the classroom and actual specimens in the Land Lab.

2. Students will be able to recreate their observations of plants by coloring drawings of the plants as they observed them in the field.

MATERIALS

For The Class:

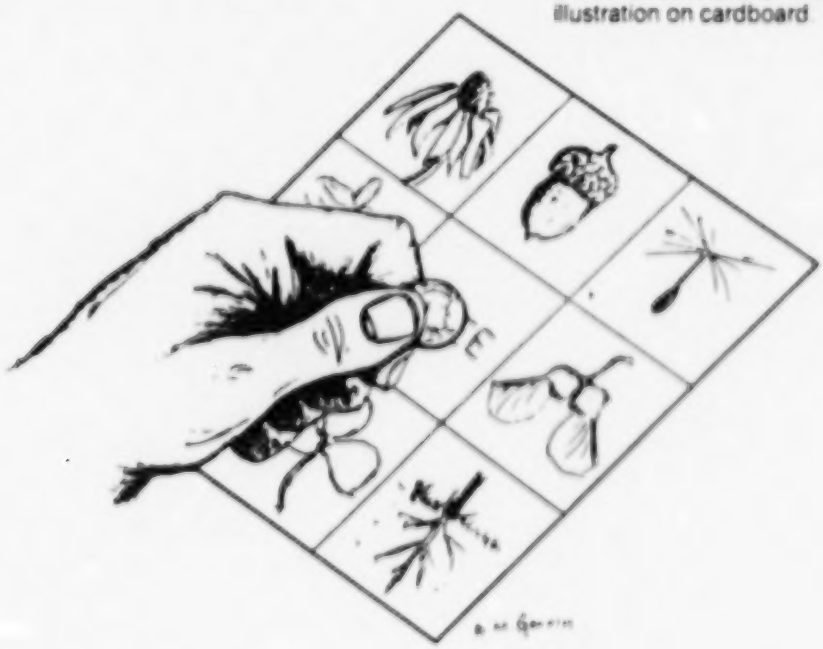
- Master of Plant Parts Bingo Board
- Set of laminated or mounted cards from Plant Parts Board

For Each Student:

- Handout of Plant Parts Bingo Board
- Clipboard with pencil (See Introduction.)
- Crayons
- Quart-size zip locked bag
- Game markers (9)

Prepwork

Photocopy the Plant Parts Board handout, producing enough copies for each student plus one extra. Prepare a set of game cards by cutting apart one copy of the handout and laminating or mounting each illustration on cardboard. Create game pieces or



Plant Parts

gather poker chips for use with the game, nine per student. Have clipboards with pencils and crayons ready for later use.

BACKGROUND INFORMATION

Scientists classify plants by grouping them according to their similarities and differences. Learning to identify different kinds of plants in the field begins with recognizing how their parts, such as **leaves, flowers** and **seeds** contained by **fruits** or **nuts**, **compare** with one another: how they are **alike** and how they are **different**. (See illustration of plant parts.) This lesson will focus on the differences in plant parts such as leaves between species. One way to compare plants is to look at the shape of their parts. Although some parts have very regular shapes (i.e. ovals, triangles, diamonds), most are irregular or a combination of these regular shapes.

The most common way of identifying plants is using the shape of their leaves. All the leaves found on one type of plant will always have the same distinctive shape or shapes. Learning to distinguish among these shapes is an important observation skill.

Another easily seen characteristic of plants is color. You and your students will see an infinite number of greens and browns in the Land Lab. Plants' colors are functional - plants are green because of chlorophyll, the chemical substance used by the plant to make food. When the plant dies, the chlorophyll breaks down and the plant parts appear brown. Some plants do have brightly colored flowers. These flowers help the plant to attract insect pollinators.

For more information, see "Speaking of Trees" , the 1995 Teachers' Resource Packet compiled by the Ottawa Park Nature Education Center.

BEFORE YOU GO

1. Introduce plant parts. Explain that parts have shapes and colors that can be used to tell them apart. For example, an acorn has a round shape and cap and comes from oak trees. Discuss colors found in plants such as green and brown in varying shades.

2. Distribute handouts and game pieces to students and discuss shapes and possible colors of the plant parts pictured. Explain that, to play the game, you will hold up a card from the Plant Part Board. When the students find a match on their handout, they should cover it with a game piece. Continue until all drawings are marked.

3. Tell your students that scientists use a similar method of matching pictures to things that they study in order to compare shape and color. The class will be doing this in the Land Lab.

4. Pass out clipboards and have the students attach their handouts. Collect game pieces, and prepare to go outside.

PROCEDURE

1. Gather your students along the fence and explain that they will be trying to find the plant parts illustrated on their handouts. Encourage them to look at the shape and color of the parts they find. Ask the students to collect samples. Discuss the importance of choosing samples that won't harm a living plant (i.e. dead leaves from the ground). **Do not collect flowers or living leaves other than those of dandelions and clovers. Do not collect bark or fruit still attached to the tree or plant.** The free (empty) square will be used to draw a discovery not on the handout.

2. Set boundaries and allow the students to explore until the majority have collected the most available samples.

3. Gather the students along the fence. Highlight representative samples of what was collected. Note shapes and colors.

4. Explain that the samples need to be returned to the Land Lab to make soil, grow into plants, etc. To make a permanent record of what was seen, have the students mark the boxes next to the plant parts on their handouts which they saw or collected with pencil. Have them return samples to the Land Lab when the activity is completed.

5. If desired, bring in samples of plant parts found in the Land Lab for students to draw from. These samples need to be returned to the Land Lab when your class is finished with them. Return to classroom.

CONCLUSION

1. Have the students remove their handouts from the clipboards and look at the pictures again. Discuss shapes that they see and the colors that they observed outside.

2. Have the students draw their free-square plant part and color the illustrations as they remember them. Encourage students to continue looking for differences in the shapes and colors of plants.

JOURNAL QUESTIONS

Brainstorm to come up with ideas for the following: "One thing I didn't know" and/or "My favorite plant part". Draw an idea you came up with.
Use the handout as a classroom or personal journal entry.

EXTENSIONS

1. **Leaf Rubbings**. Have your students collect a variety of fallen leaves from the Land Lab or park. Using newsprint or other light-weight paper and crayons, have them make rubbings of the leaves before returning them to the environment. The sides of crayons without wrappers work best. Suggest that the students group the rubbings according to shape or other ways that they can be compared.

2. **Nature Colors Palette**. Make copies of an artist's palette on heavy drawing paper or cardboard, one copy for each of your students. Using the same guidelines as were used in the Plant Parts activity, have your students find natural objects of varying colors and crush and rub them on the palette to produce a smudge of color. Encourage the students to group similar shades together on the palette. What colors are most common in nature?

3. **Shape or Color Hunt**. Cut a variety of shapes from heavy drawing paper or colored construction paper, enough for one per student or one per group of two to four students. Laminate or mount the shapes to increase their durability. Distribute the shapes to your students and instruct them to match the shapes with things that they observe in the Land Lab or surrounding park. Colored construction paper or paint sample cards from a hardware store can be used in a color matching exercise.

4. **Plant Part Show-and-Tell**. Have your students bring in examples of plant parts from their homes or yards. Have the class try to name the plant parts collected (i.e. carrot = root, celery = stem, lettuce = leaves, broccoli = flowers, pecan = nut or fruit, sunflower seeds = seeds, cinnamon stick = bark).

5. **Coffee Filter Chromatography.**
Scientists use acetone to separate the different pigments in leaves and other plant parts. Since acetone is flammable and poisonous, caution should be used around young students. An alternative is to use a water-based magic marker instead of plant material to make a large dot on the coffee filter strip and substitute water for acetone. To demonstrate that one species of plants contains many colored pigments, prepare a chromatogram for your students. Collect a handful of fresh leaves (Norway maple and Sweetgum work well) and grind them finely in a mortar and pestle or glass blender. Add 1/4 to 1/2 cup of acetone and mix. Continue to add acetone in small increments and mix until a thick puree consistency is achieved. Transfer the mixture to a glass jar and insert a strip of filter paper, cut from a coffee filter and suspended from a pencil, into the mixture. The bottom of the strip should extend about 1/2 an inch (1 cm) into the mixture but should not touch the bottom of the jar. Allow the experiment to sit for 1 to 2 hours. Remove the filter strip and allow it to dry. Show the students that the many colored pigments in the leaves have traveled different distances on the filter strip and created separate bands of color.

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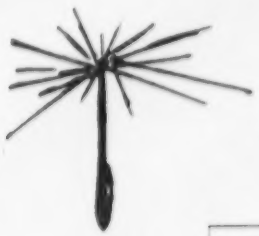
Told in simple rhyme, these verses celebrate the marvels of trees.

Jevnesse, Gallimard, Claude Delafosse and Rene Mettler, Authors. Rene Mettler, Illustrator. 1991. Flower. Cartwheel Books/Scholastic, Inc. New York, NY. (TLCPL)
Colorful illustrations and overlays describe different kinds of flowers and that they make fruits and seeds.

Wexler, Jerome. 1987. Flowers, Fruits and Seeds. Prentice-Hall. New York, NY. (TLCPL)
Photographs of various plants and trees show characteristics of different fruits, seeds and flowers and depict the cycle from flower to fruit to seed to flower.

PLANT PART PAIRS BINGO BOARD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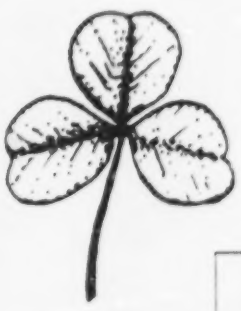
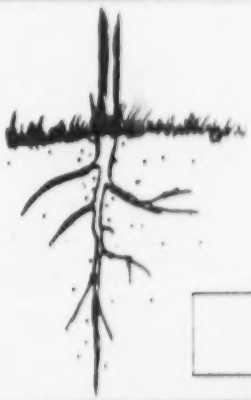
		

Propagation
From Seed To Tree

GRADE LEVEL/TOPIC: K-1/Plants

TIME REQUIRED/RECOMMENDED SEASON: 90 to 120 minutes/Autumn

SCIENCE SKILLS: Observing, Collecting, Record Keeping

KEY WORDS: Habitat, Fruit, Nut, Seed, Sprout, Soil, Mulch, Water, Food, Shelter, Room to Grow

OVERVIEW

This Activity introduces types of tree seeds and the proper procedures for planting and nurturing them. It consists of an introduction to tree seeds using Tree Seed Labels (15-30 minutes), finding and planting tree seeds in the Land Lab (45-60 minutes) and plotting the planting sites on a map of the Land Lab (15-30 minutes). Watering the planting sites on a regular basis will also be necessary. This Activity may be divided into shorter sessions to accommodate your time allocation for science. (Finding and planting of seeds may be done separately.) If this is your first trip to the Land Lab, please consult the Introduction. For information on preparing the maps used in this activity, see PRE-ACTIVITY #3: Compiling A Base Map in the Getting To Know Your Land Lab section of the Introduction.

PURPOSE

1. Students will plant trees to be used in subsequent years as study specimens.

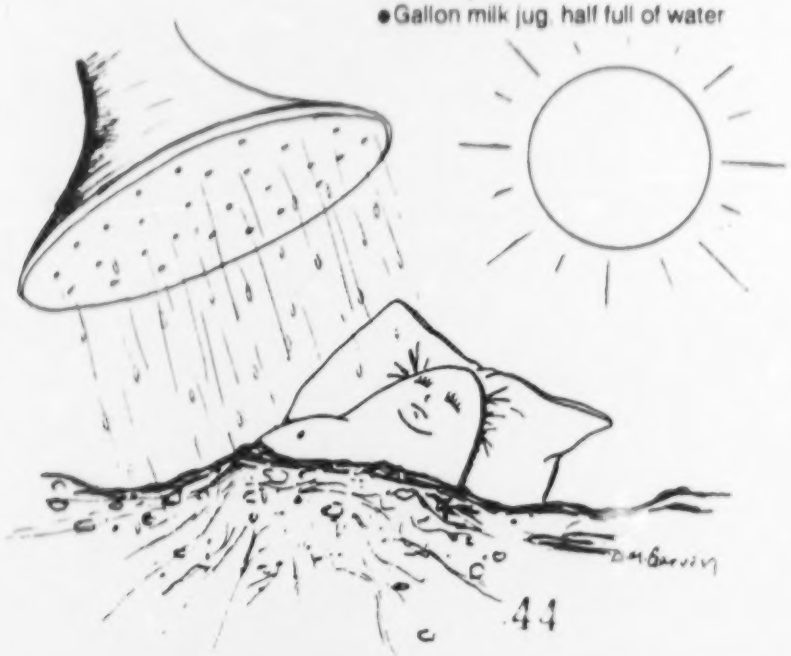
2. Students will recognize that fruits and nuts contain seeds.

3. Students will demonstrate knowledge of the needs of plants by properly planting and caring for the tree seedling.

MATERIALS

For The Class:
- Tree Seed Labels master
- Clear tape
- Permanent black marker
- Large wall map of the Land Lab
- 22 cm x 28 cm (8.5" x 11") grid sheet or map of the Land Lab
- Clipboard with pencil
- Rulers marked with masking tape or wooden blocks for measuring planting holes (2-3)
- Woodchip mulch
- Calendar for recording watering schedule

For Each Student:
- Tree Seed Labels of a buckeye, an acorn and a maple helicopter (3 - one of each kind)
- Crayons
- Popsicle stick labeled with student's name
- Zip locked bag for collecting
- Metal spoon
- Gallon milk jug, half full of water



Prepwork

Discuss the location of a suitable planting site with the PARK-IT! Committee to avoid disturbing the projects of other classes. Have students bring in gallon milk jugs from home until there are enough for one per student. Photocopy the Tree Seed Labels master, producing three different seed labels (buckeye, acorn, maple helicopter) for each student. Cut the labels apart. Mark the rulers with masking tape at 15 centimeters (6 inches) and 25 centimeters (10 inches), and label these measurements with "W" for width and "D" for depth. Wooden blocks cut to these dimensions may also be used to assist the students in measuring their planting holes. Mark one popsicle stick with each student's name to serve as a site marker. Fill the gallon milk jugs approximately half full of water. Gather the remaining materials.

BACKGROUND INFORMATION

Many students have had an opportunity to plant and encourage the growth of a seed. However, planting trees in your Land Lab enriches this opportunity by giving your students an important task: building a wildlife habitat to help replace what has been lost through the development of the park. **Habitat** which includes trees is necessary to provide for the needs of many living things. These needs include **food, water, shelter** and **room to grow.**

Seeds also have needs in order to grow and thrive, including good **soil,** sunlight, water and warm spring days. Some seeds must remain dormant through a period of freezing temperatures in the ground or in the refrigerator before they will **sprout**. This process of preparation is called cold stratification. While most of these needs will be provided for by nature, your students will have to assist with loosening the soil by digging and backfilling their holes to provide adequate air space for root development. Regular watering, at least for the first few years, will also be their responsibility. Watering is not necessary during the winter months because the trees have dropped their leaves and stopped producing food, an adaptation which allows them to survive without additional water. Lastly, the students will have to surround the young plants with woodchip **mulch** to reduce competition from the grasses.

When collecting seeds, it is important to have your students check them for holes or similar evidence that they have been eaten by insects, squirrels or other animals. Such seeds are unlikely to grow. The viability of acorns may also be tested by dropping them into 10 to 15 centimeters (4 to 6 inches) of water. Any acorns which float probably do not contain living seeds and should be discarded.

Using seeds from local trees will not only demonstrate to your students that fruits and nuts from trees contain seeds, but also assure that the new trees will be well adapted to the conditions in your Land Lab. In this activity, the seeds will be densely planted to provide a variety of plants for study in future years and to promote competition among the seedlings. Not all of the trees will survive to become part of a forest, but those that do will be the healthiest and best suited to life in the new habitat.

For more information about seeds and propagating nuts, see "Speaking of Trees", the 1995 Teachers' Resource Packet compiled by the Ottawa Park Nature Education Center.

BEFORE YOU GO

1. Introduce to your students types of seeds and their needs as outlined in the background information. Explain to them that they will be planting and caring for trees in the Land Lab to provide better habitat for wildlife. Locate your planting site as approved by the PARK-IT! Committee on the large map of the Land Lab.

2. Distribute the three different Tree Seed Labels and a zip locked bag to each student. Have the students color their stickers and attach them to their collecting bags with clear tape so that they can be used to find examples of the desired nuts or fruits.

3. Explain to the students that they will be sent on a scavenger hunt in the Land Lab and surrounding park to collect three of at least one kind of seed represented on their labels. Collect the 22 cm x 28 cm (8.5" x 11") grid sheet or map of the Land Lab, clipboard with pencil and labeled popsicle sticks (one per student). Have the students carry their collecting bags, spoons and jugs of water with them when the class goes outside.

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PROCEDURE

1. With your students, locate the planting site within the Land Lab. Have the students leave their spoons and water jugs in the planting area to mark the site where they will plant their seeds. Space the individual planting sites so that the students are standing a full arms-length apart.

2. Establish boundaries and send the students on a scavenger hunt to find the pictured seeds. Instruct them to return to the planting site when they have found three of at least one kind of seed.

3. When the students return to the planting site, help them check the seeds for holes or other evidence that they have been eaten. Discard any seeds with holes, and send the students to find more if necessary.

4. When they have found three usable seeds, instruct the students to prepare their planting sites by clearing all grass, including roots, from an area about 30 centimeters (12 inches) square.

5. Have the students plant their three seeds. Instruct them to dig holes with their spoons approximately 25 centimeters (10 inches) deep and 15 centimeters wide (6 inches) wide (to loosen the soil), checking the size of their holes with the marked rulers or wooden blocks. Then have the students backfill the holes to 2.5 centimeters (1 inch) from the top and place their three nuts on top of this soil. Instruct them to finish filling in the holes, packing the soil gently.

6. Encourage the students to care for the seeds by covering them with woodchip mulch and watering them. Have the students cover their planting sites with two handfuls of woodchip mulch, enough to cover their holes, and slowly and carefully pour the water from their milk jugs over the area.

7. Pass out the popsicle sticks labeled with the students' names so that they can mark and personalize their sites. Record the location of each planting site on your map. Return to the classroom.

CONCLUSION

1. Have each student mark his or her planting site on the large map of the Land Lab with the label of the seed planted. Use your map to help them find the exact locations.

2. Explain to the students that their seeds will require three months of cold temperatures (winter) before they will grow roots and sprout and that they will need care in the meantime. Work out a schedule to care for the seeds and record it on the calendar. Have the students check the mulch and water the seeds with a half gallon of water once a week for the remainder of Autumn and beginning again after the spring thaw. It is best to water first thing in the morning to minimize water loss to evaporation. Once the seeds sprout, the students may need to add more mulch around the plants to reduce the competition from grasses.

3. Maintain your care schedule throughout the school year except during the winter months. Have the students take turns drawing a drop of water on the calendar each time your class waters the seeds, and let each student draw a tree on the calendar when his or her seed sprouts. Be sure to make arrangements for watering during the summer as this is the most critical period for the young seedlings.

JOURNAL QUESTIONS

Draw a picture of the seed that you planted, and put the labels of the seeds that you did not plant on the same page. Count the number of each seed planted on the map of the Land Lab, and write the numbers next to their pictures.

Write the date that your seed was planted and the date that it sprouts on the page.

Draw a drop of water near the picture each time you water your seed.

EXTENSIONS

1. **Cold Stratification**. Seeds may be collected in the autumn and planted in the spring if they are cold stratified in the refrigerator over the winter. Have your students put their seeds in zip locked bags with a handful of moist soil or sand and label their bags with the correct Tree Seed Labels and their names in permanent black marker. Plant the seeds after the spring thaw.

2. **Planting Wildflowers**. If your school is interested in encouraging a meadow habitat instead of or in addition to a forest, have the students collect and plant wild flower seeds. An excellent resource for this is *Growing and Propagating Wild Flowers* by Harry R. Phillips.

3. **Maple Seed Mix-up.** To demonstrate the odds of a seed having all its needs met and actually sprouting, play Maple Seed Mix-up with your class. For a class of 24 students, write or draw maple seeds, favorable conditions for seed growth and hazards on small squares of construction paper in the numbers indicated below:

Maple Seeds (4)

Favorable Conditions (16)
Good Soil (4)
Sunlight (4)
Warm Spring Days (4)
Water (4)

Hazards (4)
Drought (1)
Hungry Rabbit (1)
Lawn Mower (1)
Sidewalk (1)

The construction paper can be color coded for younger students, if desired (i.e. brown = seeds, green = favorable conditions, red = hazards). Establish four bases in a square (ball diamond, four cones) before beginning the game. Shuffle the squares of paper, and have each student draw one and conceal it in his or her hand or a pocket from the other students. When all students have a square, instruct them to run around the four bases which you have established until you tell them to stop. When you shout "Stop!", the students should run to the nearest base and wait. Visit each base, and have the students display their squares. If a seed and all four favorable conditions are present, the seed can sprout. If any of the hazards are present or one of the favorable conditions is lacking, any seed in the group cannot sprout. If time allows, continue playing until at least one seed is able to grow. Hurray!
(National Wildlife Federation, 1985)

4. "**Trees Are Growing**". Sing this song adapted from the lyrics of Susan Peters (Warren, 1993) with your students to illustrate the tree's life cycle. The song lends itself well to full body motions!

TREES ARE GROWING
Tune: "The Farmer in the Dell"

The seeds are in the ground;
The seeds are in the ground.
With soil and rain and sunny days,
The seeds are in the ground.

The seeds are growing roots...

The sprouts are growing up...

The trees are growing bark...

The trees are growing branches...

The buds are opening up...

The trees are growing leaves...

The trees are growing fruit...

The trees are dropping fruit...

The seeds are in the ground...

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Braus, Judy, editor. 1985. Ranger Rick's NatureScope: Trees are Terrific! National Wildlife Federation. Washington, DC. p. 32. (TLCPL)

Dirr, Michael A., and Charles W. Heuser, Jr. 1987. The Reference Manual of Woody Plant Propagation: From Seed to Tissue Culture. Varsity Press. Athens, GA. pp. 11-21.

Garvin, Denny, Linda Courter and Marilyn DuFour. 1995. Speaking Of Trees: 1995 Teachers' Resource Packet. City of Toledo, Division of Forestry. Toledo, OH. 44 pp. Available in limited quantity from the Ottawa Park Nature Education Center, 2201 Ottawa Parkway, Toledo, OH 43606. (419)936-2876.

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CHILDREN'S SCIENCE/TRADE BOOKS

Carle, Eric. 1987. The Tiny Seed. Simon and Schuster Books for Young Readers. New York, NY. (TLCPL)
"A strong wind blows flower seeds across the land. One is tiny, smaller than the others. Will it be able to grow and keep up?"

Ehlert, Lois. 1991. Red Leaf Yellow Leaf. Harcourt Brace Jovanovich. San Diego, CA. (TLCPL)
"A child describes the growth of a maple tree from seed to sapling."

Jennings, Terry. 1988. Seeds. Junior Science Series. Gloucester Press. New York, NY. (TLCPL)
"Colorfully illustrated book about what seeds are, what they need and what they grow into. Experiments and glossary."

Kellogg, Steven. 1988. Johnny Appleseed: A Tall Tale. Morrow Junior Books. New York, NY. (TLCPL)
"A story about John Chapman, known as Johnny Appleseed, who loved nature and spread cheer and apple seeds in the 1700's."

Lauber, Patricia, author. Jerome Wexler, photographer. 1981. Seeds: Pop-Stick-Glide. Crown Publishers, Inc. New York, NY. (TLCPL)
"Text and photographs describe the many different ways that seeds travel and disperse."

Moncure, Jane Belk, author. Helen Endres, illustrator. 1990. How Seeds Travel: Popguns and Parachutes. Child's World. Elgin, IL. (TLCPL)
"Describes how animals, wind, water and other methods of dispersal help to spread seeds to new places."

Ryder, Joanne, author. Michael Hays, illustrator. 1991. Hello, Tree! Lodestar Books. New York, NY. (TLCPL)
"Describes in simple text and illustrations some of the unique characteristics of trees."

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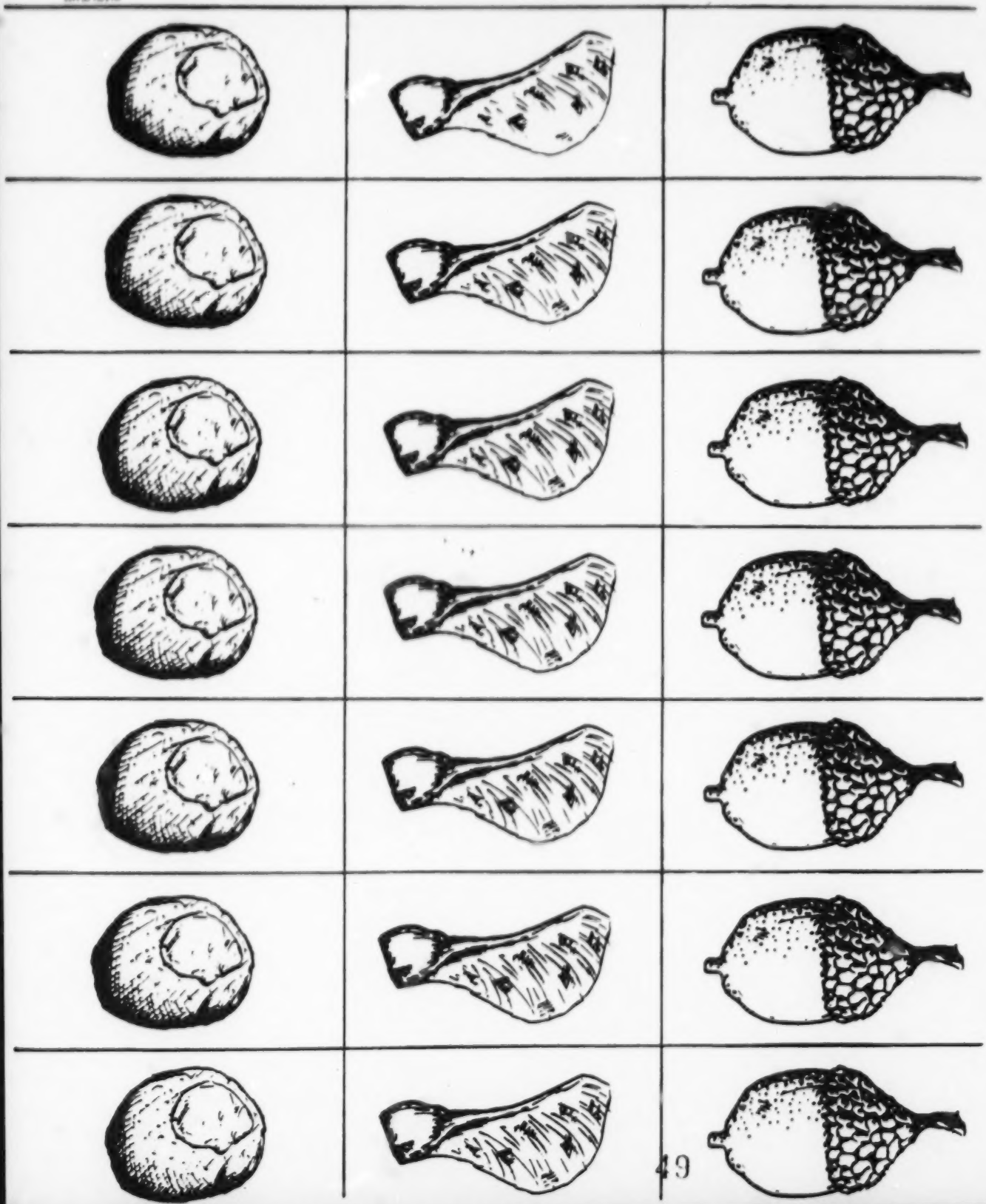
DEPARTMENT OF NATURAL RESOURCES

TREE SEED LABELS



Animal Sign Census
Who Goes There?

GRADE LEVEL/TOPIC: K-1/ Animals

TIME REQUIRED/RECOMMENDED SEASON: 85 minutes, can be divided over several days/Any season

SCIENCE SKILLS: Observing, Record Keeping, Censusing

KEY WORDS: Sign, Census, Scat, Droppings, Track, Nest, Run, Tunnel, Gall

OVERVIEW

In this Activity, students will be introduced to the concept of animal sign through an in-class demonstration (10 minutes). They will then look at the pictures on the Bingo Board included with this Activity (10 minutes). In the Land Lab, the students will look for examples of animal sign that match the pictures of sign on their bingo boards (20 minutes). They will then repeat this process for an area of mowed grass outside the Land Lab (20 minutes), and compare the amount of sign found in each (20 minutes). Feel free to divide this Activity into smaller lessons. If this is your first Activity, please consult the Introduction.

PURPOSE

1. Students will name examples of animal sign.

2. Students will recognize that more sign (and therefore more animals) are likely to be found in a natural area (such as the Land Lab) versus a mowed area.

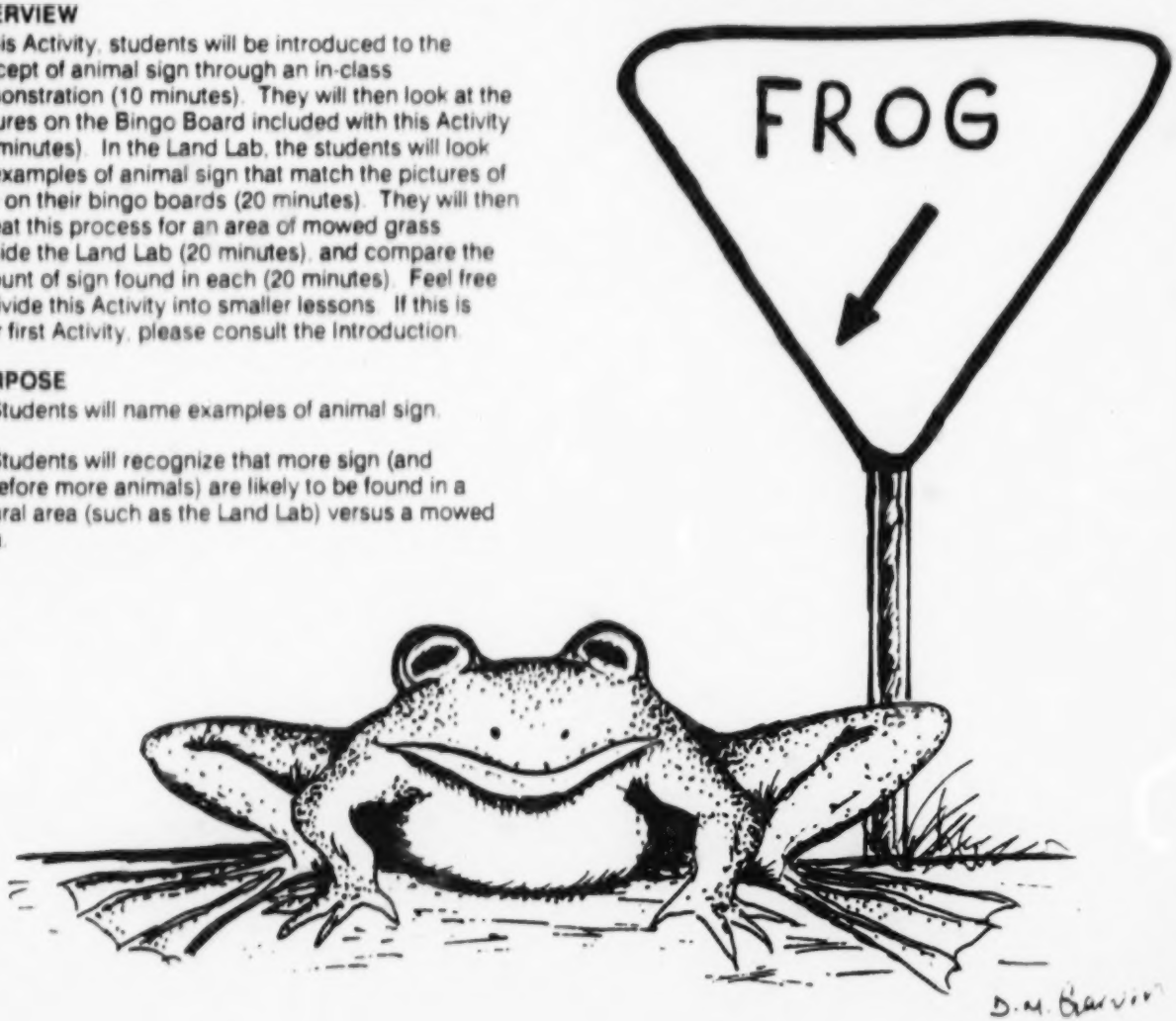
MATERIALS

For The Class:
- Sandwich, apple, peanut butter or other food (to be used as an example of sign)

For Each Student:
- Clipboard and pencil
- Animal Sign Census Bingo Board (2)
- Marking stakes (2)

Prepwork

Before this Activity, bring in food for demonstration. For directions on how to make marking stakes, please consult the Introduction. Photocopy enough Bingo Boards so that each student has two.



BACKGROUND INFORMATION

Students associate the Land Lab with wildlife. Nature documentaries on television show wildlife in profusion, and it is logical to assume that there will be lots of wildlife in this area that we have allowed to grow. We tell them (and rightly so) that there will be more wildlife in the Land Lab compared to the rest of the Park. This begs the question, "why can't we see more wildlife?

There are several reasons.

First, most mammals are **nocturnal**, meaning they are active at night. We humans are **diurnal**, and thus our activity cycles do not coincide with many of our local animals. Furthermore, animals are wary of predators. A class of noisy children can scare wildlife into hiding. This can be a good discussion for you and your students - what are good wildlife watching techniques? Finally, many animals have good **camouflage**, and can escape detection even though they are around.

Often, the **sign** it leaves behind tells us more about an animal than simply seeing the animal itself. Sign can be visual, such as a chewed leaf, or other senses can detect it. The smell of a skunk or the call of a bird are also considered sign. **Scat**, or an animal's **droppings**, can tell us about the animal's diet, and perhaps about its health. **Tracks** can also tell a wealth of information about what kind of animal made the track, the age of the animal, what sex it was and how fast it was going. Other kinds of sign include **tunnels** or **runs** made by small mammals and old birds' **nests**. Sometimes just the way the grass is pressed down is sign that a deer or other animal has been resting.

What will be in your Land Lab? There will always be some kind of sign that can be seen by observant eyes. Fallen leaves provide clues to insect lives, past and future. Holes in leaves can be signs of herbivorous insects. Look on the underside of leaves, especially those of oaks, for **galls**. Galls, which look like bumps or swellings in or on plant stems or leaves, are homes of developing or overwintering insects. Small mammals such as mice and shrews, will tunnel through the tall grass of the Land Lab, and the entrance or exit holes can be seen. Mice and shrews will also make visible tunnels through snow. Tracks made by small mammals, birds and medium - sized mammals such as raccoon, opossum and skunk may also be visible in the snow or wet mud of your Land Lab. See Extensions for two activities that allow students to study tracks more closely.

In this Activity, your students will be conducting a simple census of animal sign. A **census** is a count of something. Scientists use censuses to determine the number of plants, animals or other ecological variable in an area.

BEFORE YOU GO

1. Demonstrate the concept of animal sign by setting up the following scenario. The students are to look for clues (sign) that someone was in the classroom having a snack. Have children go out into the hall, or be out of the classroom doing something else. While they are out of the room, put a sandwich with bites taken out of it somewhere in the room where children can see it. When students come back inside ask, "How do you know someone was in the room eating?" They should eventually come up with the idea that someone was in the room because they left some food behind. Similarly, animals sometimes leave food behind when they pass through an area. If the class is observant, they may be able to find some animal sign outside. Also, explain that there are other signs that animals leave behind such as scat, tracks, tunnels, nests and the like. An alternative to using food is to put paper footprints in a line in the room as another example of sign.

2. After establishing that the half-eaten food is indeed sign, pass out the Animal Sign Census Bingo Boards and explain what each square represents. Explain the use of tally marks. The students can either mark on the board once every time they see a particular sign, or just mark on the board if a kind of sign is seen.

3. Ask whether students expect to see more sign in the Land Lab or in the mowed grass around the Land Lab. Why is this? The Land Lab provides more food and shelter for animals than does the mowed grass.

4. Pass out clipboards, pencils and marking stakes to each child. Explain that the stakes are for the children to mark sign with when they see something they would like to show the class. If desired, tell students they will be conducting a census. This means they will be recording the kind and perhaps the number, of sign in the Land Lab.

5. Take the class outside.

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PROCEDURE

1. Instruct the students to look for animal sign like that illustrated on the Bingo Board. They are to mark on the Bingo Board when they see that kind of sign.

2. Have students spread out around the Land Lab. Encourage students to bend down and look under objects in order to find sign. If they see the animals themselves, (such as invertebrates under a log or birds) have them draw that on the Bingo Board.

3. Allow 10-15 minutes for students to find animal sign. Remind students to use marking stakes if they find interesting sign.

4. Gather class to discuss the kinds of sign the students have observed. As a group, observe any sign that students have marked.

5. Using the other Bingo Board, instruct students to repeat steps 1-3 in another area of the Park. Look for an area which has been mowed, so a comparison can be made.

CONCLUSION

1. Using a blank Bingo Board, compile results of the animal sign census. Go over each square of the Bingo Board and ask those students who saw what was illustrated in that square to raise their hands.

2. Put the appropriate number of tally marks on the board for each square. Do this for both the Land Lab and for the mowed area. Students should be able to see that the Land Lab has more tally marks and the mowed area has less.

3. Why is there more sign in the Land Lab compared to a mowed area? What is going to happen, in terms of plant and animal life, when people cut down forested areas? What sort of things in nature would make animal sign show up better (snow, mud)?

4. Have students color the illustrations on the Bingo Board.

JOURNAL QUESTIONS

Put your Bingo Board in your journal.
Draw examples of the animal sign you saw in your journal.

EXTENSIONS

1. **Tracks, Tracks and More Tracks.** One way to observe tracks is to put out bait and force animals to walk through a fine, powdery material to get the bait. Bait can be canned meat (do not worry if it is spoiled) or some kind of seed or grain. Place the bait at the center of a 1m x 1m or larger piece of plywood. Sprinkle the rest of the board with flour or fine soil. Place board in Land Lab overnight and observe tracks in the morning.

2. **Walkin' the Walk.** Yet another track activity is to have the children actually try to walk using the different gaits of animals. Any of the tracking books have detailed information on this subject. Choose three or four styles of walking and have students try to walk that way.

3. **Play Bingo.** Play a game of bingo with the Bingo Board. Photocopy Board four times, cut up the squares, arrange in different orders and photocopy enough for your class. See the Plant Parts Activity in this Guide for more information.

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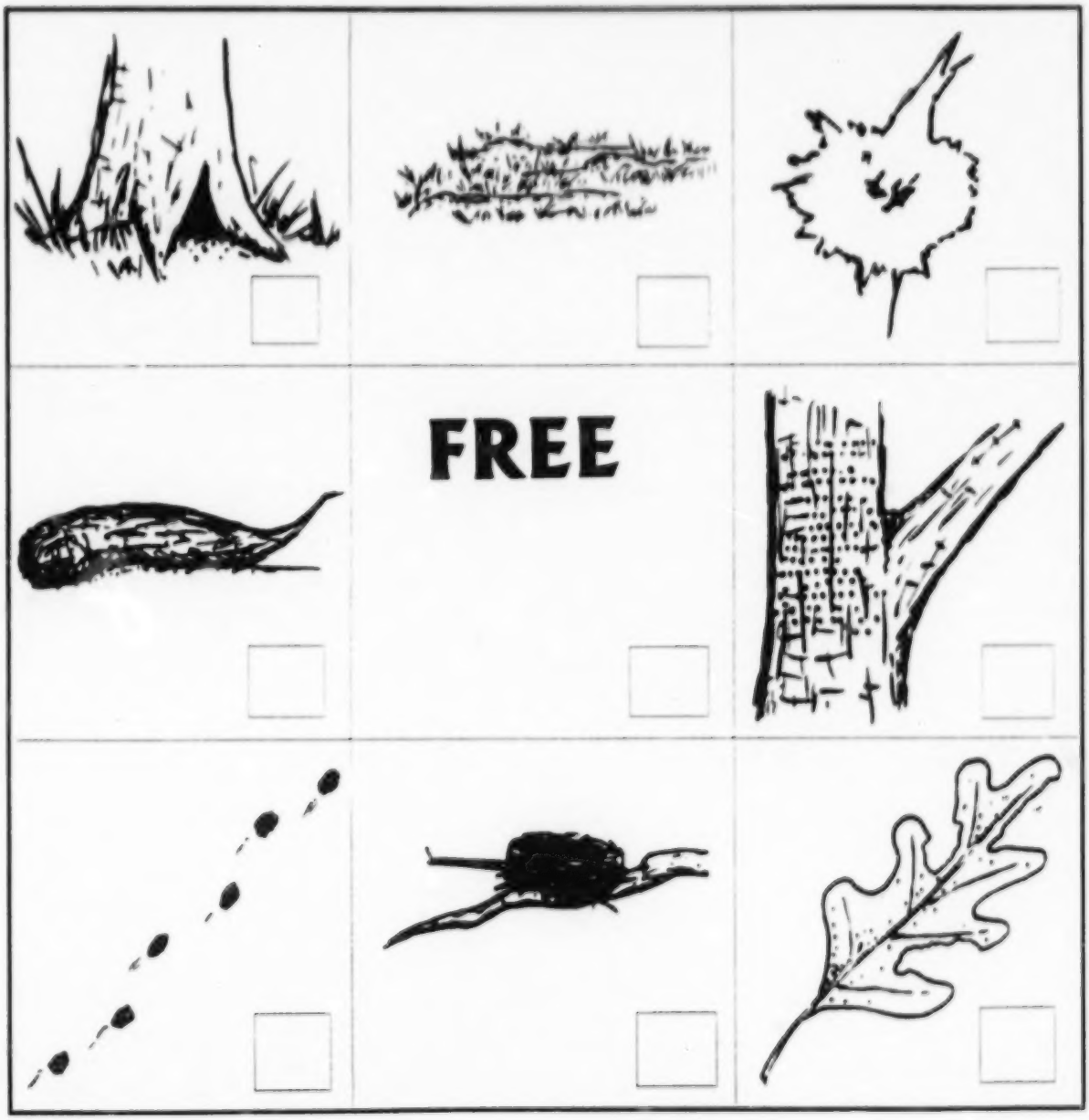
Arnosky, Jim. 1989. Crinkleroot's Book of Animal Tracking. Bradbury Press. New York, NY. (TLCPL)
"Explains how to find and understand the signs made by animals around water, in the woods and in the snow."

Arnosky, Jim. 1991. The Empty Lot. Sierra Club Books. Boston, MA. (TLCPL)
"Inspecting an empty, partially wooded lot before selling it, Harry finds it occupied by birds, insects and small mammals."

Dorros, Arthur. 1991. Animal Tracks. Scholastic. New York, NY. (TLCPL)
"Introduces the tracks and signs left by various animals, including raccoon, duck, frog, black bear and human."

BINGO BOARD

ANIMAL SIGN CENSUS



Flight Distance
I Need My Space

GRADE LEVEL/TOPIC: K-1/Animals

TIME REQUIRED/RECOMMENDED SEASON: 90 to 120 minutes/ Any season

SCIENCE SKILLS: Observing, Questioning, Measuring

KEY WORDS: Danger, Wary, Alert, Fleeing, Safety Zone, Flight Distance, Space

OVERVIEW

This Activity examines the distance to which ground-feeding animals such as squirrels and birds will allow the approach of a potential danger before fleeing. It includes classroom proximity exercises (30-45 minutes), field testing of flight distances in the Land Lab and/or the surrounding park (30-45 minutes) and follow-up charades games (15-30 minutes). This Activity may be divided into shorter sessions to accommodate your time allocation for science. If this is your first trip to the Land Lab, please consult the Introduction.

PURPOSE

1. Students will demonstrate and observe that animals have a safety zone outside of which they can be observed safely.

2. Students will recognize space as one of an animal's needs.

MATERIALS

For The Class:

- Small rocks or similar weights (2)
- Brightly colored rags or bandannas (2)
- Sunflower seed for baiting the study area
- Story book for classroom capacity exercise
- Clipboard with pencil
- Scrap paper for recording data

MATERIALS (Cont'd.)

Prepwork

Prepare two place markers by tying rocks or similar weights into the center of colored rags or bandannas. Encourage squirrels and birds into the area where you will be conducting this activity by putting out a few handfuls of sunflower seed in advance.

BACKGROUND INFORMATION

In nature, there are very few reasons that one animal would come in contact with another. These reasons include mating, defending territory and eating. For this reason, animals must always be alert to potential **danger** from larger animals, including humans, which might eat them. In fact, they are usually aware of our presence long before we become aware of theirs!

As animals are approached, they change their behavior. Response to a possible threat varies from species to species but may include becoming **wary**, freezing to assess the danger (full **alert**) and easing away or **fleeing** to safety. The distance to which an animal will allow approach before heading for safety is called the **safety zone**, or **flight distance**, and varies for each animal according to the perceived danger. (Roth, 1982) This Activity is designed to determine the flight distance for squirrels and ground-feeding birds in the park, using two students as the perceived danger.

Along with food, water and shelter, all animals need a certain **space** in which to live. This need means that only a limited number of animals can live in the park or your Land Lab. It also means that studying and enjoying the wildlife there requires good observing habits. It is important not to repeatedly approach an animal to cause flight as this is a form of harassment. These actions may interrupt the animal's feeding or cause it stress while it is caring for young or preparing for the winter. The best way to study an animal is to remain outside its safety zone and observe its normal activities and behavior.

Encourage your students to be good wildlife watchers!

BEFORE YOU GO

1. Introduce the concepts of safety zone and space to your students as outlined in the background information.

2. Demonstrate the concept of a safety zone using a simple proximity exercise. Ask a student volunteer to stand in front of the class facing you and instruct the student to raise a hand when he or she feels uncomfortable because you are too close. Slowly approach the student until his or her hand is raised. Explain that the distance between you represents this student's safety zone. Divide your class into groups of two, and have each group determine their safety zones. Do some students allow a closer approach than others?

3. Demonstrate an animal's need for space by determining the area necessary to comfortably accommodate your class. Have your students begin the exercise in their regular seats while you read them a story. Every few minutes, have them relocate into increasingly smaller fractions of the room by moving their seats or sitting on the floor. Instruct the students to raise their hands when they feel that the close proximity will distract them from listening to the story. Emphasize that your classroom can comfortably hold only a certain number of students. In the same way, the Land Lab will comfortably hold only a certain number of animals.

4. Describe the process by which your class will be determining the flight distance, or safety zone, of animals, especially squirrels and birds, in the park and/or your Land Lab. Explain that three pairs of students will be assigned to approach an animal and mark its flight distance while the rest of the class observes its behavior. Assign one pair to approach the animal, one pair to observe and mark the location of the animal when it flees to safety and one pair to mark the location of the approach team when flight occurs. Practice the procedure once in the classroom. Take the place markers, clipboard with pencil and scrap paper and go outside.

PROCEDURE

1. Lead your class quietly around the park and/or Land Lab until an animal feeding on the ground is spotted by one of the students. Stop the class and make certain that the pairs of students assigned to perform the experiment have the place markers in hand. Remind the rest of the students to observe the behavior of the animal carefully.

2. Instruct the assigned pair of students to hold hands and begin approaching the animal as quietly as possible. They should stop when the animal begins to move away or flees. When the students observing agree that the animal has fled, send the other assigned pairs to mark the locations of the animal and of the approach team.

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3. Have a fourth pair of students or your entire class measure the distance between the two place markers by counting the steps between them. Emphasize that this distance is as close as you can get to the animal without disturbing it. Write the name of the animal and the number of steps counted on the scrap paper for future reference.

4. Repeat this procedure a few times as time and available animals allow, giving additional students the opportunity to assume the assigned roles. Discuss any differences that the students observe in the behavior and flight distances of different types of animals, such as squirrels and birds.

5. Return to the classroom.

CONCLUSION

1. On the board, compile a list of animals observed in the park and/or Land Lab and their flight distances in steps. If the size of your classroom allows, have a few students count out the steps from a single point so that the class can view the distances simultaneously and make comparisons. As a class, discuss and mimic the response of each of the animals to an approaching person.

2. Whisper in each student's ear the name of one of the animals observed, being sure that at least two students are assigned each type of animal. Instruct the students to find all of the other students who have been assigned the same animal by using the behavior that they observed in the Land Lab. (No talking allowed!)

3. Reinforce the importance of staying outside an animal's safety zone when trying to observe it. How do your students feel kind wildlife watchers should behave?

JOURNAL QUESTIONS

Why do you think some wildlife will let you get closer than others?

Draw a picture of a person observing wildlife in a safe and caring way.

EXTENSIONS

1. **Walk With The Animals.** Encourage the approach teams to walk like different kinds of animals (straight and quiet as a fox, playful as a dog, jumpy as a rabbit, etc.). Which type of walk enables the students to get closest to the animal?

2. **The Lucky Number.** Assign students to approach teams of varying numbers, from a single student to the entire class. Does the number of students approaching an animal affect how quickly it flees?

3. **'Tis The Season.** Have your students determine the flight distances for various animals at different times of the year. Does the season have an effect on how closely an animal allows approach?

4. **Tracking.** Have your students follow a set of tracks through the snow or mud in the park or your Land Lab. What story do these tracks tell about the animal's behavior? If a set of tracks is not available, consider making tracks for your students to follow.

5. **Measuring Up.** Have older students measure flight distances more precisely using a yardstick or tape measure and compare their results for different types of animals.

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Project WILD. 1986. Project WILD Elementary Activity Guide. Western Regional Environmental Council. Boulder, CO. pp. 109-110, 185-186.

Roth, Charles E. 1982. The Wildlife Observer's Guidebook. Prentice-Hall, Inc. Englewood Cliffs, NJ. p. 52. (TLCPL)

CHILDREN'S SCIENCE/TRADE BOOKS

Carter, Anne, author. John Butler, illustrator. 1986. Scurry's Treasure. It's Great To Read! Series. Crown Publishers, Inc. New York, NY. (TLCPL)
"The world is seen from a young squirrel's perspective as a squirrel mistakes a brooch for a nut."

Ehlert, Lois. 1990. Feathers for Lunch. Harcourt Brace Jovanovich. San Diego, CA. (TLCPL)
"An escaped house cat encounters twelve birds in the backyard but fails to catch any of them and has to eat feathers for lunch."

Ehlert, Lois. 1993. Nuts to You. Harcourt Brace Jovanovich. San Diego, CA. (TLCPL)
"A rascally squirrel has an indoor adventure in a city apartment."

Miles, Miska. 1977. Small Rabbit. Little, Brown. Boston, MA. (TLCPL)
"A rabbit must learn to avoid predators."

Wildsmith, Brian. 1974. Squirrels. Oxford University Press. Oxford, England. (TLCPL)
"Text and watercolor illustrations describe the characteristics and habits of squirrels throughout the year."

Appendix

Fourth Grade Proficiency Test

Learning Outcomes

1. Create and use categories to organize a set of objects, organisms or phenomena.
2. Select instruments to make observations and/or organize observations of an event, object or organism.
3. Identify and/or compare the mass, dimensions and volume of familiar objects in standard and/or nonstandard units.
4. Use a simple key to distinguish between objects.
5. Analyze a series of events and/or simple daily or seasonal cycles and predict the next likely occurrence in the sequence.
6. Evaluate a simple procedure to carry out an exploration.
7. Identify and/or discuss the selection of resources and tools used for exploring scientific phenomena.
8. Evaluate observations and measurements made by other persons.
9. Demonstrate an understanding of safe use of materials and/or devices in science activities.
10. Explain the operation of a simple mechanical device.
11. Identify characteristics of a simple physical change.
12. Explain and/or predict the motion of objects and/or describe the effects of some objects on other objects.
13. Make predictions about the weather from observed conditions and weather maps.
14. Identify and/or describe the relationship between human activity and the environment.
15. Identify evidence and show examples of changes in the earth's surface.
16. Demonstrate an understanding of the basic needs of living things.
17. Identify ways in which organisms react to changing environments.
18. Distinguish between living and nonliving things and provide justification for these distinctions.
19. Analyze and/or evaluate various nutritional plans for humans.

Sixth Grade Proficiency Test
Learning Outcomes

1. Use a simple key to classify objects, organisms and/or phenomena.
2. Identify potential hazards and/or precautions involved in scientific investigations.
3. Make inferences from observations of phenomena and/or events.
4. Identify the positive and/or negative impact of technology on human activity.
5. Evaluate conclusions based on scientific data.
6. Recognize the advantages and/or disadvantages to the user in the operation of simple technological
7. Predict the influences of the motion of some objects on other objects.
8. Propose and/or evaluate an investigation of simple physical and/or chemical changes.
9. Provide examples of transformation and/or conservation of matter and energy in simple physical systems.
10. Identify simple patterns in physical phenomena.
11. Describe simple cycles of the earth and moon.
12. Identify characteristics and/or patterns in rocks and soil.
13. Demonstrate an understanding of the cycling of resources on earth, such as carbon, nitrogen and/or water.
14. Trace the transmission of energy in a small, simple system and/or identify the roles of organisms in the energy movement in an ecosystem.
15. Compare and/or contrast the diversity of ways in which living things meet their needs.
16. Analyze behaviors and/or activities that positively or negatively influence human health.
17. Analyze the impacts of human activity on the ecosystems of the earth.

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